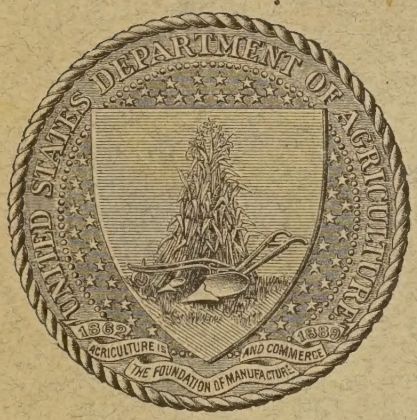
U. S. DEPARTMENT OF AGRICULTURE.

WEATHER BUREAU.

Instructions for Observers of the Weather Bureau.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1895.

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NOTICE.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., October 1, 1895.

The accompanying *general instructions* for Weather Bureau observers are published for the information of those concerned. They will go into effect at once and will replace all conflicting instructions and regulations.

WILLIS L. MOORE,
Chief of Bureau.

Approved:
J. STERLING MORTON, *Secretary.*

INSTRUCTIONS FOR WEATHER BUREAU OBSERVERS.

GENERAL INSTRUCTIONS.

Disobedience, negligence, etc., to be reported.

A strict observance of these Instructions will be required of all persons belonging to the service, and it is made their imperative duty to report forthwith, through the proper channels, to the Chief of Bureau any negligence, disobedience, or infraction which may come to their knowledge.

Promulgation of amendments.

Amendments to be put in Appendix.

Amendments and additions to these Instructions will be promulgated in the usual printed Instructions, *in duplicate;* one copy for the station file of Instructions, the second for pasting in the Appendix accompanying each set of Instructions. The copies placed in the appendix must be pasted in sequence as received, and a *red-ink* note must be made in the Instructions, opposite the paragraph affected. Thus: "Par. 25 amended; see Appendix, page 10;" or, "Par. 25 revoked; see," etc.

Extra compensation.

All employees of this service are hereby prohibited from receiving from any State, corporation, or private party any pay or emolument of any character for services rendered in connection with their official duties.

Designation of employees.

NOTE (*a*).—In these regulations, for convenience, the local forecast official, observer, or other employee in charge of a station will be designated as *official in charge;* other employees of the observing force serving with the official in charge will be termed *assistants;* the office of the Chief of Bureau will be designated as the *central office.*

Central office.

Organization.

NOTE (*b*).—The duties of the Weather Bureau, as defined by the act of Congress approved October 1, 1890 (Public No. 352), are outlined in section 3 of said act as follows:

SEC. 3. That the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, on and after July first, eighteen hundred and ninety-one, shall have charge of the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce, and navigation, the gauging and reporting of rivers, the maintenance and operation of seacoast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperature and rainfall conditions for the cotton interests, the display of frost and cold-wave signals, the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties.

Establishing station.

Building for office.

In selecting a building for occupancy as an office, the official in charge will consider especially its accessibility and locality. In general, the building occupied should be higher than those surrounding it, and should be so located that the conditions hereinafter stated as necessary for the proper exposure of each instrument will be possible.

Government building preferred.

The building should be easily accessible to the public and as near the post-office and telegraph office as possible. Whenever practicable quarters are to be secured in Government buildings or in buildings where suitable accommodations may be obtained free of cost. At points where Government buildings have been constructed, or where it is proposed to construct such building subsequent to the establishment of a station, the official in charge will promptly communicate the fact to the central office with a view of securing office rooms therein.

Erection of instruments on roof.

Except in the case of Government buildings, permission, in writing, should be obtained from the owner or agent of the building to erect the necessary instruments upon the roof, access to which must be convenient.

The official in charge will notify the central office, postmaster, telegraph authorities, and others interested, of the location of the office, giving number and name of street, as soon as practicable.

Exposure of instruments; roof plan.

In connection with the establishment of a station or the removal of an office, drawings fully showing the new or proposed exposures of instruments, with recommendations as to board walks, platforms, etc., must be submitted to the central office for approval before the instruments are finally placed in position. Although desirable, it is not necessary that the drawings or plans be made to scale, but the approximate ground size of houses, outbuildings, etc. (if instrument shelter or rain gauges have ground exposure), or size of roof, platform, walks, etc. (if shelter or gauges have roof exposure), in feet, should be given.

In preparing these plans the following points will be carefully observed:

Roof platform, walks, etc.

1. Draw plain outlines of grounds, or roof (or so much thereof as may be necessary to include all instruments), indicating houses, trees, fences, and gables, towers, etc., by straight lines *in black ink*, and proposed platforms, walks, positions of instruments, etc., by lines *in red ink*. All important dimensions and distances should be plainly marked in figures.

2. Elevations should also be sent when roofs are not flat, or when there are important projections, the character of which will not be clearly understood from the plan. *Shaded and perspective views* should not be made unless drawn according to correct geometrical principles,

Photographs.

but if photographs showing more clearly the exposure or surroundings, or office building itself, can be obtained without expense to the Bureau, these should also be forwarded with the plans mentioned above.

Obstructions on roof.

3. Indicate houses, trees, fences, towers, chimneys, gables, elevator shafts, water tanks, skylights, ventilators, etc., by words written near their location on the plan or drawing, with height above ground (or roof), as "two-story brick house with gable roof, 30 feet high to apex," "tight board fence, 6 feet high," "pointed tower, 40 feet high above roof," "live chimney, 10 feet high above roof," etc.

Live chimneys, etc.

4. Indicate all *live* chimneys on an office building roof from which instruments are exposed, and give distance, in feet, from instrument shelter to the nearest live chimney, or, if instrument shelter is located on ground or sod exposure, the distance to nearest house, fence, trees, etc.

Points of compass.

5. Always indicate the *points of the compass* on plans and drawings.

Report elevation of instruments.

When the location has been approved and the instruments placed in position, two copies of Form 1058 (Report of Position and Elevation of Instruments), must be prepared; one copy to be retained at the station for future reference, and the other forwarded to the central office. A copy of Form 1058 will be rendered whenever a change of office is made. *Changes in the position or exposure of instruments or changes from one building or room to another without the sanction of the central office are prohibited.*

(Instructions relative to executing leases, contracts, etc., in connection with the establishment of a station or the removal of an office, will be found in the chapter on accounts.)

Leases, contracts, etc.

After establishing a station the official in charge will call upon the principal citizens and officers of organizations likely to be interested in or benefited by the work of the Bureau, and also upon the editors of local newspapers, to whom he will explain the nature and object of his duties with a view of ascertaining how his observations and reports can be made of the greatest use to the public. The cooperation of the citizens visited will also be solicited in the work to be undertaken.

To call upon newspaper editors, and others.

It is advisable that a meteorological committee of three members, selected from the principal agricultural, commercial, and scientific organizations, be appointed in each city in which a station is located, to confer with the official in charge as to the best means of enhancing the value of the station. The chairman of the committee should be requested to occasionally communicate with the Chief of Bureau with reference to the manner in which the public is being served, and to suggest possible improvement. Changes in the personnel of the meteorological committee should be reported to the central office.

Meteorological committee.

Report changes in personnel of committee.

The station having been duly established, in addition to the notes to be made in the daily journal, as directed on page 20, the date and hour of taking the first observation will be telegraphed to the central office by a special message, except in cases where observations are to be regularly telegraphed to the central office, when the first cipher report will be sufficient notification.

Date and hour of first observation to be telegraphed.

In the absence of special authority from the central office to the contrary, station offices must be kept open to the public from 9 a. m. to 4 p. m., local time, except on Sundays and holidays, when Sunday duties only will be performed. Sunday duties are understood to include the taking of the usual observations and telegraphing the usual cipher report, changing the self-registering record sheets, and attending to any special work that may arise. Where there is but one person on duty at a station he is authorized to close the office *at a regular hour* for a reasonable period each day for meals, or for such brief periods as official duty may require his presence elsewhere. Whenever the office is so closed a notification must be put upon the office door giving the probable time of the employee's return. *It is to be understood, however, that provision must be made at all times at all stations for the receipt of such warnings as may be sent, or to take and telegraph such special observations as may be called for by the proper authority.*

General management of station.

Hours of duty.

At one-man stations.

Provisions for receipt of warnings.

Prompt rendition of the various reports and forms will be insisted upon, and delays or failures in this respect must be fully and immediately explained. When such delays or failures are due to physical disability the explanation must be accompanied by the certificate of a practicing physician.

Delays or failures to render reports.

An official serving alone at a station should make every effort to provide for the continuity of his observations and telegraphic reports in the event of his becoming disabled by reason of illness or other cause. This will be found practicable at most one-man stations. The names and post-office address of persons available for temporary employment in emergencies will be noted in the journal on the last day of each month.

Continuity of observations to be provided for.

Telegraphic requests for authority to temporarily employ extra help will state the lowest rate per day at which such help may be secured. In all cases where telegraphic authority is conveyed to the official in

Employment of temporary assistance.

charge for the employment of assistance temporarily, it is to be understood that the compensation allowed shall *not exceed $2 per day* unless otherwise indicated by the central office.

Compensation.

Upon the receipt of a telegram directing the detail of an assistant for duty at another station, the official in charge will, in his acknowledgment of the telegraphic orders, report the name of the employee selected.

Give name of man selected.

The official in charge will see that the work of the station is properly and impartially distributed among the employees, including himself.

Distribution of station work.

Requests for authority for messengers to occasionally take and record observations will be considered. Authority therefor, however, will be granted only upon the condition that such work on the part of messengers shall be in addition to, and not in lieu of, their regular duties as messengers; and, in any case, the official in charge will be held responsible for the accuracy of the observation and record.

Authority for messenger to take observations.

Officials in charge of stations must place such assistants in charge during their temporary absences as are best fitted to perform the duties of that position, due regard being paid to length of service, length of time at station, and ability; but ability will be given the greatest weight in making a selection. When two men are considered equal in ability and general fitness, the one older in the service of the Bureau must be selected. The main object sought is to have at all times the affairs of the Bureau conducted by those best fitted to administer its functions.

Selection of assistant to have charge temporarily.

Requests for change of station for personal reasons will not be favorably considered when such change will involve the Government in expense.

Change of station.

When an official is relieved from charge of a station he will inform his successor of the location of all Government property placed in his care, introduce him to citizens and prominent members of organizations especially interested in or benefited by the work of the Bureau, and give such further information as will enable his successor to intelligently take up the duties of the station. A *joint* written report to the effect that the instructions in this paragraph have been complied with will be transmitted to the central office, together with a statement showing the *actual date and hour of the transfer of the station duties and property responsibility.*

Relief from station.

Joint report to be made.

The employee succeeding to the charge of the station will, as soon as practicable, transmit a full report upon the condition of the station at the time of its transfer to him. (For instructions relative to responsibility for the correctness of meteorological forms upon transfer of station see page 25, and for those pertaining to property responsibility at the time of transfer see page 57.)

Condition of station to be reported.

Instructions from the central office, whether by mail or telegraph, relative to change of station or other movement of the station force, will be *immediately* acknowledged and executed with promptness. Unless otherwise ordered, the acknowledgment will be by mail.

Instructions to change station, acknowledge and execute promptly.

An employee traveling under orders will report the hour and date of "departure" and "arrival" promptly, using separate blanks. Delays en route will be fully explained, and in case of illness the explanation will be accompanied by the certificate of a practicing physician.

Hour, etc., of departure and arrival to be reported.

Annual leave of absence, with pay, for a period not exceeding thirty days in any calendar year, may be granted a commissioned employee when his duties can be properly performed without additional expense to the Government.

Leave.

Leave for one working day.

When the interests of the service will permit the official in charge of a station is authorized to absent himself, or grant leave of absence to any of his commissioned subordinates, for a period not exceeding one working day, without expense to the United States and without interference with the duties of the station. Such absence must be charged to "annual leave" and duly reported to the central office. An employee granted leave of absence under this authority will not visit the central office for the purpose of transacting official business without especial permission from the Chief of Bureau.

Will not visit central office.

For more than one day make application to central office.

Permission to be absent for a period exceeding one day must be obtained from the central office. If sought by an official in charge, the request for leave must give the name of the assistant designated to act in the absence of the former; if by an assistant, whether by telegraph or otherwise, it must show the recommendation of the official in charge. Every request by mail must show the applicant's previous absences, from every cause (except on official business authorized or directed by the central office), during the calendar year.

Departure and arrival to be reported.

An employee granted a leave of absence for more than one day must promptly report to the central office the hour and date of his departure from and return to station. The report of departure (which must not be held to accompany the report of return) must give the telegraphic address of the absentee for the period during which he is to be absent if the request for leave contemplates absence from the city in which the applicant's station is located.

Address to be given.

Pro rata leave, first year of service.

The officials in charge of stations will bear in mind that in the case of new appointees pro rata leave only may be granted during the first year of service, i. e., two and one-half days for each month's service.

Sickness.

Absence on account of sickness (except in cases referred to above) not exceeding two days may be covered by the certificate of the official in charge, mailed on the day of return to duty. If, however, at the close of the second day, or earlier, it is evident that the absence will continue beyond a period of two days it will be reported at once. The probable duration of the disability will also be given, and the central office advised from time to time of the condition of the absentee. The certificate of a practicing physician will be required for a continuous absence exceeding two days.

Report to be made.

Thirty days absent sick.

When an employee has been absent sick thirty days in a calendar year, whether continuously or not, and even though he be still absent, the central office must be so informed and the proper certificate forwarded.

When serving alone, disability to be reported by telegraph.

When an employee serving alone at a station is incapacitated for the performance of duty he will notify the central office at once by telegraph, briefly giving the cause, probable duration of the absence, and suggestions as to performance of station work, so that the necessary action may be taken by the Chief of Bureau, such telegram to be immediately followed by the certificate of a practicing physician. Should the employee be able to arrange for the performance of his duties without extra expense to the Bureau the telegram will be omitted and a report of the absence will be made by mail, accompanied by the physician's certificate, as above.

Return to duty.

Reports showing return to duty from absence on account of sickness will indicate previous absence sick during the calendar year.

Sickness during leave of absence.

Personal sickness occurring during absence on leave will not be considered as absence on account of sickness.

Absence for two days to inspect State weather service stations.

An official in charge of station and also serving as director or assistant director of a State weather service, or who has charge of substations in the marine, river, or cotton-region services, is authorized to absent himself from his station *for the purpose of establishing or inspecting such stations or for duty in connection with State weather service work* under his supervision for periods not exceeding forty-eight hours without obtaining permission in advance; departure from and return to station to be reported promptly on return to station.

Departure, etc., to be reported.

No expense to be incurred.

The authority contained in the foregoing paragraph conveys no right to incur expense in the name of the United States.

Give authority for all absences.

Every report of absence from station, whether on duty or annual leave, must be accompanied by reference to the authority under which the absence occurred.

Blanks for reporting absence.

All absences must be reported on blanks provided for that purpose.

Unauthorized absence to be reported.

The official in charge will report immediately to the central office any unauthorized absence on the part of employees serving under him; and likewise any employee of the Bureau will promptly report unauthorized absence on the part of the official in charge. The report in either case to be made by telegraph or letter, as the circumstances may require.

Appointments.

Appointments to the observing and messenger forces are made through the medium of the United States Civil Service Commission, which conducts the examination required by law of Congress, and to which all inquiries relative to such appointments will be referred.

Probationary term.

Appointments to the classified service are made for a probationary period of six months. Beginning with the probationary period, the assistant must be given instruction in the practical duties of the service. At telegraph stations appointees should be encouraged to practice telegraphy; at stations furnished with typewriting machines, a reasonable time should be devoted each day to practice typewriting until proficiency is attained. In giving instruction to probationary appointees, especial attention will be devoted to the requirements of these instructions. At the end of each month during such period a report of progress and proficiency will be made to the central office, and at the end of the fifth month the official in charge will state in writing his opinion as to whether the manner in which the appointee's duties have been performed warrant permanent appointment.

Telegraphy and typewriting.

Instruction during probationary term.

Report of progress.

Report at end of six months.

Following is the oath of office required of appointees:

Oath of office.

OATH OF OFFICE.

I, ——— ———, do solemnly ——— that I will support and defend the Constitution of the United States against all enemies, foreign and domestic; that I will bear true faith and allegiance to the same; that I take this obligation freely, without any mental reservation or purpose of evasion; and that I will well and faithfully discharge the duties of the office on which I am about to enter. So help me God.

——— ———.

Subscribed and sworn to before me this —— day of ———, A. D. 189—.

[SEAL.]

——— ———,
Notary Public.

Preparation of official letters, etc.

All papers, reports, letters, etc., must be prepared in due official form, and both address and signature thereon must show the official designation or title given by the appointing power.

Correspondence to be brief.

Official correspondence should be made *brief*, without impairing the subject.

Abbreviations should be avoided in all official communications and papers; also the use of superfluous words. Abbreviations.

Communications intended for the central office must be addressed, *by title only*, to the "Chief of Weather Bureau, Washington, D. C." How to be addressed.

Communications from assistants will be considered only when transmitted through the official in charge of the station. Communications from assistants.

Two or more subjects *must not* be referred to in one communication, but two or more communications may be inclosed in one envelope. Two or more subjects in one communication.

Printed forms and other periodical reports will be transmitted in separate envelopes and marked as shown on Form 4024, Mis. 1895. Likewise, bills and letters necessarily accompanying them, vouchers, pay rolls, and other papers pertaining *exclusively* to payment for supplies or *previously* authorized services, will be transmitted in a separate envelope marked in the lower left-hand corner "Accounts." Forms, reports, etc., to be sent in separate envelopes.

Confidential communications will be inclosed in an envelope marked in the lower left-hand corner "Confidential." Confidential communications.

Press *clippings* (not whole newspapers) relating to the work of the weather service, damage to crops by stress of weather, loss of life by violent storms, descriptive of meteorological phenomena, bearing on sanitary climatology and vital statistics, etc., should be forwarded to the central office on printed slips provided for that purpose when such clippings can be obtained without expense to the Bureau. The official in charge should encourage his correspondents to forward clippings to him under the same conditions for transmittal to the central office. Letters of transmittal should not accompany press clippings except when some explanation with reference to the subject is demanded. Clippings. Letters of transmittal.

Letters received will be neatly folded to one size. Folding.

Letters received from the central office will be briefed in the name of the division or section of the office writing them. The brief should show simply serial number of the letter by calendar year, the date of receipt, place whence directed, date when written, subject, and number of inclosures, if any. Each inclosure should bear the number of the *letter received* and a *subnumber*. Letters received. Brief. Inclosures.

The action taken on a communication received at a station will be noted on a memorandum slip and the slip filed with the letter itself, or in its place, should it be necessary to "refer" the letter from the station. Note action taken on slip.

In all cases where a letter received is removed from the files of the station for any purpose, such removal must be accounted for by filing in the place of the letter a memorandum slip giving the serial number of the letter and showing the disposition of it. Removal from files.

Telegrams containing forecast, signal, or cold-wave orders, and other warnings (not being of an administrative character) will not be treated as letters received, but will be carefully and neatly preserved. Telegrams not to be entered.

Access to the files of letters received and record of letters sent may be had only upon application to the official in charge, and at no time will persons not connected with the station, unless serving in the capacity of Weather Bureau inspectors under the orders of the central office, be given access to such letters or other records of a confidential nature without written authority from the central office. Letters received and sent not open to inspection.

Official communications from persons not connected with the service which do not solely relate to the duties of the station, will be at once forwarded to the central office with the proper indorsement. Communications from those not in service.

Indorsements on letters from central office.

Letters received from the central office *will not be returned by indorsement* unless it be so directed.

Circular letters.

Circular letters received should be separately and neatly filed and indexed; printed "Instructions" should also be separately filed.

To keep copies of letters sent.

Copies of all communications sent will be retained at the station.

Folding letters.

Letters addressed to the central office, when written on letter paper, should be folded in three folds; when on paper of foolscap size, in four folds, and briefed by the writer on the first fold as follows: Place where written, date, name of official signing communication (surname first), and designation; subject, briefly. *At the top of the brief a space of 1½ inches should be left blank for the dating stamp of the central office.* This space likewise will be left when letters are returned or transmitted to the central office by indorsement. In the lower left-hand corner, on the face of the letter, the number of inclosures, if any, will be stated, and the inclosures also referred to in the body of the letter.

Letters sent to be briefed.

Space at top to be left.

Inclosures.

Press copies.

In making press copies of letters sent care must be exercised to avoid illegible copies. If by accident a copy should be rendered wholly illegible, a second copy will be made on the succeeding page of the book, and a proper note made on the blurred page. Where only parts of the letter are illegible, corrections may be made with a lead pencil. The leaves of the book will in no case be torn out.

Illegible copies.

Indorsements, where placed, and how made.

Indorsements should be placed on the second fold of a letter and numbered. When all of the folds of the letter have been filled by previous indorsements, the necessary paper should be neatly pasted on the last fold for succeeding indorsements. Reports and remarks of considerable length, when called for by indorsement, will be made on a separate sheet, in which case the indorsement will be after the usual heading, "Respectfully returned, etc., inviting attention to inclosed report." A copy of each indorsement must be retained at the station, as in the case of letters sent.

In reply, give name of division, etc.

In replying to letters from the central office the name of the division from which the letter was received should be referred to, as also the subject (giving the file number mentioned, if any) and date. When more than one letter is addressed to the central office on the same subject, each letter succeeding the first must refer to the date, etc., of the previous communication.

Letters to public officials.

Letters to public officials on official business must be addressed to them in their official capacity. Except in communicating on routine business directly connected with the station, communications to officials of other Departments or Bureaus should be addressed through the Chief of Bureau.

Manuscript reports, how prepared.

In preparing manuscript reports that do not partake of the nature of a letter, but which may be of general interest, an employee should write on paper of letter size, leaving a margin of 1½ inches, so that the paper may be stitched in book form if considered advisable.

Index letters received and sent.

The record of letters received and letters sent will be carefully and neatly indexed as follows:

Letters received.

Letters received—under the name of the division or section, when from branches of the central office, otherwise under the name and official title of the writer; name of place, except when from the central office; subject. When from Chief of Bureau or chief clerk, only their official titles will be entered.

Letters sent.

Letters sent—under the name and title of the person addressed; place; subject. When sent to the Chief of Bureau, the name of the person addressed and the place may be omitted.

Letters-received and letters-sent books will be labeled to indicate the character of the contents, and the period covered from first to last letter, together with the name of the station. Example: Books to be labeled.

Letters received.
From January 1, 1895, to December 31, 1897.
Boston, Mass.

An official furnished with a typewriting machine will see that all his correspondence is typewritten, so far as practicable. Use typewriter.

Correspondence between employees of the Bureau and the central office, relating to the work or concerning the personnel of the service, will be EXCLUSIVELY with the Chief of Bureau, and when the writer deems advisable the Chief may be addressed personally. Unauthorized correspondence.

Care must be taken to see that authorized correspondence is couched in courteous language. Remarks reflecting upon the work of other stations or the personnel of the service will be made only after careful consideration and for the best interests of the Bureau. Letters of censure or commendation will be reserved for the signature of the Chief of Bureau, or for the signature of the chief clerk, under his direction. Character of correspondence. Letters of censure or commendation.

Signatures to all communications and written reports must be written, not stamped, and followed by the official designation of the writer. Signatures to be written.

Copies of all circular letters issued at the respective stations must be forwarded to the central office for the information of the Chief of Bureau. When practicable, and such action will not result in harmful delay, proposed circular letters will be submitted for approval, except those of an ordinary character relating to routine business, or disseminating information contained in instructions from the central office, and simple requests on voluntary observers, crop correspondents, etc. Circular letters, copies to be forwarded.

The heading for station correspondence paper will be as follows: Letterheadings.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
——— ———, 189—.

In the case of the larger cities the name of the city, street, number, and building may also be printed, but specific authority therefor must be obtained from the central office.

Weather Bureau officials in charge of State weather services cooperating with the National service are authorized to use, for correspondence in connection with State weather service only, such letterheads as may be furnished them gratuitously by the cooperating organization; provided the cooperation of the "U. S. Department of Agriculture, Weather Bureau," and the name and official title of the Weather Bureau representative are expressed thereon. When the paper is furnished at the expense of the Government, the heading will be prepared in accordance with the rule given for ordinary station paper, except that the words "State weather service" may be printed in the upper left-hand corner of the paper to indicate cooperation on the part of the National service. Letterheads, State weather services.

Penalty envelopes, cards, wrappers, or writing paper bearing the official heading must not be issued to persons other than commissioned employees of the Bureau, except upon authority from the central office, and when issued under such authority, they must have the address written or printed upon the face of the envelope, card, etc. Penalty envelopes, etc., issue of.

The use of official stationery for private correspondence is prohibited. Official stationery not for private use.

Criticisms.

Criticisms on the work of the Bureau coming to the notice of an employee should be promptly communicated to the central office through the proper channel. It is not within the province of an employee to engage in controversy or discussion, oral or written, with reference to such criticisms. Matters of this nature may be properly left to the judgment of the Chief of Bureau, and for his action.

Telegraph, use of.

In cases where the delay of the mail will be plainly prejudicial to the public interests, the commercial telegraph lines may be employed in the transmission of official messages.

Telegrams, how addressed.

The telegraphic address of the central office will be "Weather, Washington." The telegraphic address of stations will be "Observer, ——— (name of station)."

Check, telegrams.

Telegrams to the central office will be checked "collect," unless paid for by the sender.

Private messages.

Messages on the personal business of the sender must be prepaid as private messages at commercial rates. Telegraphic requests for leave of absence and replies thereto will be transmitted at the expense of the applicant.

METEOROLOGICAL OBSERVATIONS.

Purposes to be subserved.

The degree of success attained in making forecasts of weather changes from synoptic charts depends in a measure upon the correctness of the work of observation at outlying stations. It would seem that so obvious an inference would scarcely need insisting upon, yet it is found by experience that too great stress can not be laid upon this single important point. It is also necessary, as a prerequisite to intelligent work, that the purposes to be subserved by the observations be clearly understood and that we know exactly the physical meaning of the various readings that are recorded in an observation. We should also know how to eliminate as far as possible the effect of causes that we do not desire to measure, so that our final result shall represent within the limits of assignable error the true measure of the various elements that enter into the record.

Circulars ex planatory of instruments.

Circulars of instruction bearing upon the theory and use of the various meteorological instruments that comprise the equipment of a station have been issued, as shown by the list given below. Each employee is expected to familiarize himself with the matter contained in these circulars and to be able at all times to successfully manipulate any instrument that may be in use at the station. It is expected that the official in charge will see that each of his assistants has an opportunity to become familiar not only with the instrumental equipment of the station, but also with all phases of station work.

LIST OF INSTRUMENT ROOM CIRCULARS.

Obtaining and transcribing records.

Circular A. Instructions for obtaining and transcribing records from recording instruments:

Anemometer register.

(*a*) Single, double, and triple anemometer register.

Float rain gauge.

(*b*) Float rain gauge.

Sunshine recorder.

(*c*) Thermometric sunshine recorder.

Sunshine recorder.

(*d*) Photographic sunshine recorder.

Barograph.

(*e*) Barograph.

Thermograph.

(*f*) Thermograph.

Maximum and minimum thermometers.

Circular B. Instructions for use of maximum and minimum thermometers.

Rain gauge.

Circular C. Instructions for use of rain gauge.

Anemometry.

Circular D. Anemometry. Pertaining to the anemometers, wind vanes, supports, registers, electric circuits, etc.

Weighing gauge.

Circular E. Instructions for using weighing rain and snow gauge.

Barometer.

Circular F. Barometers and the measurement of atmospheric pressure.

Soil thermometers.

Circular G. Instructions for using combined maximum and minimum soil thermometers.

Radiation thermometers.

Circular H. Instructions for using maximum and minimum radiation thermometers.

Atmospheric moisture.

Circular I. Thermometers and the measurement of atmospheric temperature and moisture.

Clouds.

Accurate and systematic cloud observations are urged by meteorologists of all countries as a means of developing our knowledge of the atmospheric circulation in cyclonic and anticyclonic systems, the motions of the upper air currents, and other kindred problems. The trained observers of the Weather Bureau, making simultaneous observations and using the same terms when referring to identical forms, have an exceptional opportunity for doing effective work in this branch of original research.

Relation of clouds to weather changes.

The precise relations which cloud forms bear to coming weather changes should be studied for each locality, always being careful to distinguish between the several types, to note the changes from one form to another, and the weather sequences that follow. At stations issuing a daily weather map it will be found profitable to enter cloud observations on a copy of the map, preserving the latter for future study.

Cloud nomenclature.

The cloud nomenclature heretofore in use at Weather Bureau stations will be superseded by that adopted by the International Meteorological Committee at its meeting of August 20–24, 1894, as soon as the necessary details can be arranged.

Classification.

The classification of the ten principal forms adopted by the committee is:

a.—Detached or rounded forms (chiefly in dry weather).

b.—Widespread or veil-like (rainy weather).

A. Highest clouds, mean altitude, 9,000 meters.

a. 1. Cirrus.

b. 2. Cirro-stratus.

B. Intermediate clouds, 3,000 to 7,000 meters.

a. { 3. Cirro-cumulus.
{ 4. Alto-cumulus.

b. 5. Alto-stratus.

C. Low clouds, below 2,000 meters.

a. 6. Strato-cumulus.

b. 7. Nimbus.

D. Clouds formed by the diurnal ascending currents.

8. Cumulus. Apex, 1,800 meters; base, 1,400 meters.

9. Cumulo-nimbus. Apex, 3,000 to 8,000 meters; base, 1,400 meters.

E. Elevated fog, below 1,000 meters.

10. Stratus.

Description of clouds (modified from those in the Hildebrandsson-Köppen-Neumayer Atlas):

Description of clouds.

Cirrus.

1. *Cirrus* (Ci.). *Isolated feathery clouds of fine fibrous texture, generally of a white color,* frequently arranged in bands which spread like the meridians on a celestial globe over a part of the sky and converge in perspective toward one or two opposite points of the horizon. (In the formation of such bands Ci. S. and Ci. Cu. often take part.)

Cirro-stratus.

2. *Cirro-stratus* (Ci. S.). *Fine whitish veil,* sometimes quite diffuse, giving a whitish appearance to the sky, and called by many cirrus haze, and sometimes of more or less distinct structure, exhibiting tangled fibers. The veil often produces halos around the sun and moon.

Cirro-cumulus.

3. *Cirro-cumulus* (Ci. Cu.). Fleecy cloud. *Small white balls and wisps without shadows, or with very faint shadows, which are arranged in groups and often in rows.*

4. *Alto-cumulus* (A. Cu.). Dense fleecy cloud. *Larger whitish or grayish balls with shaded portions, grouped in flocks or rows, frequently so close together that their edges meet.* The different balls are generally larger and more compact (passing into S. Cu.) toward the center of the group, and more delicate and wispy (passing into Ci. Cu.) on its edges. They are very frequently arranged in lines in one or two directions. Alto-cumulus.

5. *Alto-stratus* (A. S.). *Thick veil of a gray or bluish color,* exhibiting in the vicinity of the sun and moon a brighter portion, and which, without causing halos, may produce coronæ. This form shows gradual transitions to cirro-stratus, but, according to the measurements made at Upsala, was only half the altitude. Alto-stratus.

6. *Strato-cumulus* (S. Cu.). *Large balls or rolls of dark cloud which frequently cover the whole sky, especially in winter,* and give it at times an undulated appearance. The stratum of strato-cumulus is usually not very thick, and blue sky often appears in the breaks through it. Between this form and the alto-cumulus all possible gradations are found. It is distinguished from nimbus by the ball-like or rolled form and because it does not tend to bring rain. Strato-cumulus.

7. *Nimbus* (N.). Rain clouds. *Dense masses of dark formless clouds with ragged edges,* from which generally continuous rain or snow is falling. Through the breaks in these clouds there is almost always seen a high sheet of cirro-stratus or alto-stratus. If the mass of nimbus is torn up into small patches, or if low fragments of cloud are floating much below a great nimbus, they may be called fracto-nimbus ("Scud" of the sailors). Nimbus.

8. *Cumulus* (Cu.). Woolpack clouds. *Thick clouds whose summits are domes with protuberances, but whose bases are flat.* These clouds appear to form in a diurnal ascensional movement, which is almost always apparent. When the cloud is opposite the sun the surfaces which are usually seen by the observer are more brilliant than the edges of the protuberances. When the illumination comes from the side this cloud shows a strong actual shadow; on the sunny side of the sky, however, it appears dark with bright edges. The true cumulus shows a sharp border above and below. It is often torn by strong winds and the detached parts (fracto-cumulus) present continual changes. Cumulus.

9. *Cumulo-nimbus* (Cu. N.). Thunder cloud; shower cloud. *Heavy masses of clouds, rising like mountains, towers, or anvils, generally surrounded at the top by a veil or screen of fibrous texture ("false cirrus") and below by nimbus-like masses of cloud.* From their base generally fall local showers of rain or snow, and sometimes hail or sleet. The upper edges are either of compact cumulus-like outline, and form massive summits, surrounded by delicate false cirrus, or the edges themselves are drawn out into cirrus-like filaments. This last form is most common in "spring showers." The front of thunder-storm clouds of wide extent sometimes shows a great arch stretching across a portion of the sky which is uniformly lighter in color. Cumulo-nimbus.

10. *Stratus* (S.). *Lifted fog in a horizontal stratum.* When this stratum is torn by the wind or by mountain summits into irregular fragments they may be called fracto-stratus. Stratus.

In order that each employee of the Bureau may become familiar with the new classification, it is ordered that a special study of the foregoing be made. New classification to be studied.

The present nomenclature will be used in recording cloud observations and telegraphing them to the central office. Present nomenclature to be telegraphed.

Cloud movement.

The direction of cloud movement is sometimes incorrectly reported by observers, due to their mistaking upper for lower clouds and *vice versa*. They are therefore cautioned to be particularly vigilant in this respect so as to avoid taking or reporting incorrect observations.

Errors in same.

When two stations near each other report upper clouds moving in diametrically opposite directions it is very probable that one of the observers has been mistaken either in the kind or direction of the clouds reported.

FORMS.

Classification of forms.

The several forms employed by the Bureau to facilitate and expedite the transaction of its business are classified under the following heads:

Meteorological: Numbers range from 1001 to 2000.

Accounts or supplies: Numbers range from 2001 to 3000.

Telegraphic: Numbers range from 3001 to 4000.

Miscellaneous: Numbers range from 4001 to 5000.

Departmental forms.

Certain forms relating to accounts are not numbered according to the above classification, but these in all cases are general departmental forms and do not pertain to the work of the Weather Bureau alone.

Serial numbers, changes in.

No change in the serial number or character of forms rendered by the several classes of stations will be made except on the authority of the central office.

Instructions on back of.

It is the endeavor to make each form complete in itself, instructions for its preparation being printed thereon, as far as practicable.

List of forms.

Form 4024 has been provided in order to facilitate and systematize the preparation of forms and reports, and to serve as a reminder and convenient check list for the mailing of the same to the proper divisions of the central office. It contains a complete list of all forms in use for the current year and the name of the division at the central office to which the form should be mailed.

Daily journal.

Form 1014, daily journal. The importance and value of a well-kept daily journal is self-evident, and as suggestions and directions covering its preparation are only partially provided for elsewhere, the following remarks relating to the details to be recorded therein will guide the observers in the performance of this work and tend to secure a desirable uniformity:

Its use.

The object in keeping a daily journal is to make a record of those characteristics of the weather not easily susceptible of tabulation, and to preserve for reference a complete history of the events of the day. Questions frequently arise as to the details of the weather on some particular day which can not be gleaned from the tabulated records, and can only be had from a well-kept journal.

Subjects entered therein.

It is not advisable to attempt to define in detail the subjects that shall be entered in the journal, but there are certain general topics that should always receive attention.

Weather conditions.

On lake and seacoast stations gales, storm warnings, and any phase of the weather that may impede or seriously hinder navigation should receive full treatment in the day's journal.

Precipitation.

The beginning, ending, and amount of precipitation, the depth of snowfall, etc., should always be entered in the daily journal, as also all changes in the office force, absence with leave by reason of sickness or other cause, and all events that are likely to be referred to in future years.

Phenomena.

In reporting meteorological phenomena too much care can not be exercised to make the account explicit and intelligible to others than the writer. Very often the omission of a single detail renders the report worthless. The time of occurrence should be accurately stated.

Time, how designated.

In speaking of midnight it should be understood as referring to the end of the day and receive the date thereof; thus, whatever occurs at 11 hours 59 minutes of July 1 should be recorded of that date, and whatever occurs one minute later, viz, at 12 hours, should be recorded as occurring at midnight of July 1; and whatever happens one second later occurs at 12 hours and 1 second a. m. of July 2. It is recommended that 12 midnight be written thus: 12 mid.; and 12 noonday, 12 noon. There will then be no cause for misapprehension.

Midnight.

Night.

In speaking of the night the date should always be given, thus: The night of the 3d (sunset of 3d until daylight of 4th).

Opening station.

The first pages of the daily journal, in the case of opening a new station, must show the date of the observer's arrival, rent of the office, its occupancy, the beginning of observations, elevation of the instruments, and all other information necessary for future reference.

Aurora.

Auroral displays should be described in the journal, giving in all cases, when practicable, the time of beginning and ending, the azimuth and altitude of each extremity, and of the crown of any arch of light that may be formed. Azimuths should be recorded as in astronomy, from the south point to the westward, passing successively through the west, north, and east points of the compass until 360° have been passed over and the starting point reached.

Time of display recorded.

If an auroral display occurs on parts of two days the journal of the second day should begin, "Auroral display, continued." In counting the number of auroral displays those occurring on parts of two days will be counted as a single display.

Frosts.

Autumn.

Winter.

In the autumn the dates of all frosts will be recorded in the daily journal and monthly meteorological report (Form 1001), from the date of the occurrence of the first light frost until the date on which the first killing frost occurs. During autumn and winter frosts will not be recorded subsequent to the first date on which killing frost occurs.

Designation.

Frosts will be designated as "light" "heavy" or "killing." The term "light" signifies no destructive effects; and "heavy" or "killing," a frost that is destructive to vegetation and the staple crops.

Telegraphing.

(See the Weather Code for instructions relative to telegraphing the dates of frost to the central office.)

Record in spring.

In the spring all frosts will be recorded as indicated below: South of latitude 30°, or in California, Oregon, or Washington, after February 15; south of latitude 33°, after March 1; south of latitude 35°, after March 15; south of latitude 38°, after April 1; south of latitude 40°, after April 15. Frost occurring at any station after April 15 will be recorded.

Optical phenomena.

Various optical phenomena are constantly occurring in the atmosphere, and while they have no very important bearing upon the weather, it is advisable to note their occurrence in the daily journal. Among these phenomena may be mentioned solar and lunar halos, rainbows, coronas, parhelia, and paraselenæ, mirages, etc.

Meteors.

Whenever a meteor is seen the "cloud" left by it should be carefully noticed, both as to its appearance and the direction in which it floats.

Character of sunset.

The condition of the western sky at sunset, or at the 8 p. m. observation, when the sun does not set until after that observation, will be noted in the daily journal and Form 1001. When the sun is visible and there is no bank of clouds in the west it will be recorded and telegraphed as "fair." When the sun is obscured by any of the lower forms of clouds it will be recorded and telegraphed as "foul."

Fair.

Foul.

Thunderstorms.

In recording thunderstorms, the following wording will be used: First thunder heard at ———; loudest at ———; last at ———; storm came from the ———, and moved toward the ———; temperature before the storm, ———; after, ———; direction of the wind before the storm, ———; after, ———; hail began at ———; ended at ———; size of hailstones (diameter), ——; maximum wind velocity, —— miles; amount of precipitation, —— inches. Other data in reference to the general character of the storm will be given immediately following the above form. If the storm occurs during the night, and it is not possible to obtain the information called for above, or any portion of it, a note to that effect must be made in the journal of the day of occurrence.

Tornadoes defined.

A tornado is defined as a violent local storm in connection with which is noted (by day) a well-defined, pendant, funnel-shaped cloud, with attendant rotary winds of sufficient violence to uproot trees, prostrate dwellings, and otherwise leave unmistakable evidence of violent and rotary winds.

Description to be obtained.

Whenever a tornado occurs in the vicinity of the station the official will make a diligent effort to obtain an accurate description of all meteorological elements accompanying the tornado—the hour and date of occurrence, direction of movement, appearance of the clouds, direction of the whirl, rainfall, accompanying noise, length of track, average width at different points, amount of destruction to property, loss of life, etc. Loss by hail, lightning, floods, and to crops, orchards, forests, etc., need not be entered.

Did lightning or a thunderstorm occur in funnel cloud.

Note particularly whether lightning was observed or a thunderstorm occurred in the funnel cloud itself, or before or after. State, if possible, whether persons on the north side and less than 500 feet away saw débris moving to their right. Note carefully, also, the direction in which the débris and trees were laid in the center of the path, on the right side (south), or left side (north). So much of this information will be given as can be learned without leaving station for such time as to require special permission.

Statistics by correspondence.

If it should be necessary to gather statistics of tornadoes by correspondence, information upon the following points will be found of advantage:

Information to be obtained.

1. A map of the track, with distribution of débris on either side.

2. Name of town and time of occurrence. If the storm passed near a town, the distance and direction from the town.

3. A personal description of the appearance: Glow, funnel, lightning, white cloud, meeting of two clouds, etc.

4. Character of precipitation; rain and its amount; hail, and its size.

5. Nature of attendant noises.

6. The direction of motion of the storm.

7. Appearance of any whirl, either in the distribution of débris or in the appearance of the clouds.

8. The general direction in which trees or débris lay in the center line of greatest destruction and on either side.

9. Width of the path of greatest destruction.

10. Number and names of all persons killed.

11. Give an accurate estimate of the destruction of structures by the wind. In this be careful to exclude all loss to crops, orchards, or standing timber. Loss from hail, floods, etc., should also be omitted, though these facts may be added in a separate paragraph if desired.

Additional subjects to be noted in journal.

Note all changes in the working force of the station, together with the date and nature of such changes; a change of office or of an instrument, and date thereof; changes in elevation of instruments and the authority for making the same. These entries should be complete in every particular.

Changes in force.

Instruments.

Navigation.

At lake and seacoast stations the opening and closing of navigation, with the name of the first vessel to arrive and the last one to depart, should be recorded.

Snow.

Officials will note each day the number of inches and tenths of inches of snow (not melted) which fell during the preceding twenty-four hours, determined as accurately as possible by measurements made at points where the snow appears to be of average depth. Also, whether the snow lies evenly on the ground or in patches and drifts, and whether sidewalks are free or covered with sleet or ice, etc.

Precipitation from fog, frost, etc.

Deposits in the rain gauge due to fog, frost, or dew will be carefully noted in the daily journal, but not in the monthly meteorological report. Precipitation, as understood by the Weather Bureau, includes deposits of rain, hail, sleet, snow, and mists.

Comparative barometer readings.

The result of the comparative barometer readings, made in accordance with instructions, will be noted under the proper dates.

Instructed substitute.

The entry for the last day of the month will contain, in addition to other data, the names of all persons other than the regular force employed during the month, with compensation, together with the name and address of the instructed man, who can replace the regular observer or assistant in case of necessity and the date of receipt of all circulars and instructions.

Marginal index.

All important subjects recorded in the journal will be indexed on the side margin of each page in red ink.

CLIMATIC DATA AND RECORDS IN COURT.

Climatic data, how supplied.

The climatic data accumulated at the several stations of the Bureau afford an opportunity for special studies and investigations which should be encouraged whenever possible.

Compilation of data.

Compilations of a reasonable amount of data may be made when the nature of other duties will permit; but when the data requested by an applicant can not be furnished without interfering with the current duties of the station, or require a considerable time to prepare, the request will be referred to the central office, and the applicant so informed.

Data to be accurate and copies to be made.

Great care must be taken as regards the accuracy of the data furnished, and press copies will in all cases be retained, with additional annotations showing date, names, and addresses of persons to whom furnished. Remarks as to purposes for which obtained and other information may be made on the retained copy if considered advisable by the official in charge.

Official data for courts of law and private use.

The United States Supreme Court has decided (case of Evanston *v.* Gunn, October, 1878) that the record kept by a person employed in the Weather Bureau of the United States, whose public duty it is to record truly the facts therein stated, is competent evidence of such facts. Officials of the Bureau must bear in mind that the records which they keep are a part of the records of the Department of Agriculture and that by law they are in the custody of the Secretary of Agriculture.

Custody of records.

Certified data.

Officials in charge of stations will inform applicants that duly certified copies are always furnished when necessary for legal purposes.

Section 882, Revised Statutes. Records as evidence in court.

Section 882, Revised Statutes of the United States, 1878, provides that "copies of any books, records, papers, or documents in any of the Executive Departments, authenticated under the seals of such Departments, respectively, shall be admitted in evidence equally with the originals thereof."

Subpœnas, how obeyed.

The work of meteorological observations must be made at fixed hours, and the reports, to be of value, must make up a continuous series; therefore officials will request that the courts so time their attendance that none of their duties provided for by act of Congress are interfered with. The position of the observer as a Federal official does not impair his right to the legal fee, except when subpœnaed by the United States, and his fee as a witness may be demanded when the subpœna is served.

ACCURACY IN METEOROLOGICAL WORK.

Meteorological work to be verified.

It should be the invariable rule of each employee who has to do with meteorological observations that he verify his work before entering it upon the records, and each official in charge of a station should insist upon the checking of each observation before the day's work is done. The cipher telegraphic report (Form 1061) should also be checked as to the accuracy of the cipher words used.

Forms, responsibility for accuracy of.

At stations where local forecast officials are on duty, at State weather service centers, and at other specially designated stations the official in charge may delegate the responsibility for the accuracy of the more important forms, such as Nos. 1001, 1002, 1003, 1015, 1017, 1021, 1022, 1026, 1040, 1070, and 1083, to an assistant noted for his ability and trustworthiness; such responsibility to be limited, however, to matters of copying, compiling, computing, etc. In all questions of judgment, where it is necessary to put a construction upon an order, ruling, etc., or to designate the proper method of recording atmospheric phenomena, the official in charge shall be responsible, and the latter must exercise general supervision over the meteorological work of his assistants, examining and checking it as frequently as may be necessary, and will be held jointly responsible with them for the general appearance and accuracy of all forms. He will also be held *directly* responsible, as at present, for errors on all forms whatsoever that can be detected by cursory examination of the forms; and if the number of errors made at his station is unduly large (seventy or more errors in six months) it will be considered evidence that he is not giving proper attention to this class of work, and he will be censured conjointly with the assistant or assistants making the errors.

Signature to forms.

The assistant preparing any one of the above-named forms will sign his name on the lower left-hand corner.

Commended for accuracy.

Local forecast officials, observers, and assistants who prepare Forms 1001, 1002, etc., and who do not make more than nine errors in six months, or at the rate of nine errors in six months for any portion of the time not less than *three* months, will be commended in instructions.

Commended for accuracy in observations, etc.

Assistants who take twenty-four or more regular observations per month and prepare Forms 1021, 1022, 1026, barograph or thermograph (either or both), 1040, and 1070, for a period of not less than three months, and whose record for accuracy comes within the above limit, will also be commended.

Errors, name of person to be given.

Local forecast officials and observers, in letters to the central office reporting errors in telegraphic reports, or failures to properly perform any of the station duties, will in each instance give the name of the person responsible therefor.

Change of station. Responsibility of officials.

The retiring official will be held responsible for errors in the office records up to the date of his relief, which date should be noted in the original record and journal.

Records to be examined.

Upon assuming charge of an office, the incoming official will at once examine the books and records. If they are not complete to date, he will report the fact by telegraph and request his predecessor to await further instructions. He should at once familiarize himself with the instructions and duties of the office.

RECORDS.

Protection of records.

All books of record must have the name of the station to which they belong plainly written on the fly leaf, and they will be carefully protected from injury or defacement. Each complete record book will be marked on its back in bold figures with the number it makes in the series to which it belongs; the books will be numbered in the order of their date.

TIME.

Standard of time.

Seventy-fifth meridian time will be used by all employees of the Weather Bureau in making and recording observations and preparing official papers of any kind.

Time to be used.

At stations where the general public is using other than seventy-fifth meridian time the weather bulletins, maps, and reports will contain both the seventy-fifth meridian time and the time in use.

Clock, to what time adjusted.

The clock will be hung upon the wall of the room used for an office, and kept carefully adjusted to seventy-fifth meridian time.

Explanation of meridian time.

Seventy-fifth meridian time is the mean solar time of the meridian 75° west of Greenwich, and is five hours slower than Greenwich time. *Central, Mountain,* and *Pacific* times are the mean solar times of the meridians 90°, 105°, and 120°, respectively, west of Greenwich, and are six hours, seven hours, and eight hours, respectively, slower than Greenwich time, or one hour, two hours, and three hours, respectively, slower than seventy-fifth meridian time.

Error of clock to be corrected.

Officials will endeavor to secure at least twice each week from the telegraph office, railway office, or local jeweler the error of his clock on the standards in use by such offices, and will make the reduction to seventy-fifth meridian time. Those who do not have access to railway or telegraph time signals will, in order to obtain the proper correction for keeping the clock on seventy-fifth meridian time, obtain the local meridian time from jewelers or by the use of sundials.

As the time in use by railways, telegraph offices, and the communities at all stations west of the limit of seventy-fifth meridian time differs from that time, the official must be careful to note the amount of this difference, in order that his clock may be properly regulated to, and the observations made upon the designated moments of, seventy-fifth meridian time.

Seventy-fifth meridian time, how obtained.

If none of the four standards (*Eastern, Central, Mountain,* or *Pacific*) be in use at the station, then by reference to the table (Report of the chief of the Weather Bureau, 1891–92, p. 11) the difference between the true local meridian time and seventy-fifth meridian time must be found. If the station is east of the seventy-fifth meridian, the difference found in the table will be subtracted from the true local meridian time; and if the station is west of the seventy-fifth meridian, the difference found in the table will be added to the true local meridian time, the result in either case will be seventy-fifth meridian time.

BOOKS FOR STUDY.

Books suggested for study.

For convenience of employees of the Weather Bureau who may wish to pursue a course of reading in meteorology, the following list is suggested as containing the most important sources of information relating to meteorology and its applications.

Signal Service and Weather Bureau publications.

But few of the publications of the Signal Service and the Weather Bureau are mentioned, as a complete list of these may be found in Appendix No. 11 of the Chief Signal Officer's Annual Report for 1891.

GENERAL TREATISES.

Abercromby, R. Weather. A popular exposition of the nature of weather changes from day to day. 2 ed. 8vo. London, 1888. 41 9 pp.

Bebber, W. J., van. Handbuch der ausübenden Witterungskunde. 8vo. Stuttgart, 1885–86. Pt. I, 402 pp.; Pt. II, 513 pp.

Blanford, H. Vade Mecum.

Buchan, Alexander. Handy book of meterology. 12mo. Edinburgh, 1868. 318 pp., 6 pl.

Davis, Wm. M. Elementary meteorology. 8°. Boston, 1894. 355 pp., 6 ch.

Deschanel, A. Privat. Elementary treatise on natural philosophy, translated by J. D. Everett. 10 ed. 8vo. New York, 1890. 1180 pp., 3 pl.

Ferrel, William. Recent advances in meteorology. Ann. Rep. Chief Signal Officer 1885. Pt. II. 8°. Washington, 1885. 440 pp.

Flammarion, Camille. L'atmosphère; météorologie populaire. 8vo. Paris, 1888. 808 pp., 15 pl.

Flammarion, Camille. The atmosphere. Translated by J. Glaisher. 8vo. New York, 1873. 453 pp.

Greely, A. W. American weather. A popular exposition of the phenomena of the weather, including chapters on hot and cold waves, blizzards, hailstorms, tornadoes, etc. 8vo. New York, 1888. 298 pp., 24 ch.

Moore, J. W. Meteorology, practical and applied. 8°. London, 1894. 445 pp., 4 pl.

Russell, Thomas. Meteorology. Weather and methods of forecasting. River and flood predictions in the United States. 8°. New York and London, 1895. xxiii, 277 pp., 24 ch.

Günther, Siegmund. Die Meteorologie ihren neusten Standpunkte gemäss und mit besonderer Berücksichtigung geographischer Fragen dargestellt. 8vo. München, 1889. 312 pp., 71 pl.

Loomis, Elias. Treatise on meteorology, with collection of meteorological tables. 8vo. New York, 1883. 350 pp., 3 pl.

Marié, Davy H. Météorologie générale. Les mouvements de l'atmosphère et les variations du temps. 8vo. Paris, 1877. 528 p., 24 ch.

Mohn, H. Grundzüge der Meteorologie. Die Lehre von Wind und Wetter nach den neusten Forschungen. 4th ed. 8vo. Berlin, 1887. 374 pp., 23 ch.

Schmid, Ernst Erhard. Lehrbuch der Meteorologie, nebst einem Atlas von 21 Kupfertafeln. Text: 8vo. Leipzig, 1860. 1015 pp. Atlas: Obl. 4°. Leipzig, 1869. 21 ch.

Scott, Robert H. Elementary meteorology. 4th ed. 8vo. London, 1887. 424 pp.

Sprung, A. Lehrbuch der Meteorologie. Im Auftrage der Direktion der Deutschen Seewarte bearbeitet. 8vo. Hamburg, 1885. 419 pp.

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Modern meteorology. A series of six lectures delivered under the auspices of the [London] Meteorological Society in 1878. 12mo. London, 1879. 186 pp., 2 pl.

DYNAMIC METEOROLOGY.

Abbe, Cleveland. Mechanics of the earth's atmosphere. (A collection of translations of papers by Hagen, Helmholtz, Kirchoff, Oberbeck, Hertz, Bezold, Rayleigh, Margules, and Ferrel.) Smithsonian Mis. Collection. 8vo. Washington, 1893. 324 pp. (Corrected edition.)

Abbe, Cleveland. An account of the progress in meteorology and allied subjects. 1879-1881; 1882; 1883; 1884. In Smithsonian Reports, 1881–1884. 8vo. Washington, 1883-1885.

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Davis, W. M. Whirlwinds, cyclones, and tornadoes. 12mo. Boston and New York, 1884. 90 pp., 2 pl.

Dove (H. W.). The law of storms considered in connection with the ordinary movements of the atmosphere. 2d ed. Translated by R. H. Scott. 8vo. London, 1862. 336 pp.

Espy, James P. Philosophy of storms. 8vo. Boston, 1841. 592 pp.

Espy, James P. The fourth meteorological report. 4to. Washington, 1857. 240 pp., 70 maps.

Ferrel, William. A popular treatise on the winds, comprising the general motions of the atmosphere, monsoons, cyclones, tornadoes, waterspouts, hailstorms, etc. 8vo. New York, 1889. 512 pp., 2 pl.

Guldberg, C. M., and Mohn, H. Études sur les mouvements de l'atmosphère. Parts I and II, 4to Christiania, 1876, 39 pp., 4 pl.; 1880, 53 pp.

Hann, J. Studien über Luftdruck- und Temperaturverhältnisse auf dem Sonnblickgipfel, nebst Bemerkungen über Bedeutung für die Theorie der Cyclonen und Anticyclonen. Sitzungsb. Akad. Wien. Vol. C. 1891, 367–452.

Hazen, H. A. The Tornado. New York, 1889. 143 pp.

Loomis, Elias. Contributions to meteorology. Revised edition, chapters I–III. 4to. New Haven, 1885–1889. 232 pp., 51 pl.

OCEAN METEOROLOGY.

Attlmayr, Ferdinand, Handbuch der Oceanographie and maritimen Meteorologie. Band I–II. 8vo. Vienna, 1883. 1019 pp., 3 ch.

Boguslawski, G., and Krümmel, O. Handbuch der Oceanographie. Band I, 8vo, Stuttgart, 1884, 417 pp.; Band II, 8vo, Stuttgart, 1887, 607 pp., 60 ch.

Findlay, Alexander G. A text-book of ocean meteorology, compiled from the sailing directories for the oceans of the world. 8vo. London, 1887. 247 pp., 5 maps.

Finley, John P. The sailor's handbook of storm track, fog, and ice charts of the North Atlantic Ocean, and hurricane track charts of the Gulf of Mexico. 4to. Boston, 1889. 30 pp , 51 ch.

Maury, Matthew F. Physical geography of the sea and its meteorology. 1st ed., 8vo, New York, 1855; 15th ed., 8vo, London, 1874.

Piddington, Henry. The sailor's horn book for the law of storms. 1st ed. 8vo, London and New York, 1848; 6th ed., 8vo, London, 1876. 408 pp.

Rosser, W. H. The law of storms considered practically. 2d ed. 8vo. London. 1886. 156 pp., 2 pl.

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Blanford, H. F. A practical guide to the climates and weather of India, Ceylon, and Burmah, and the storms of Indian seas, based chiefly on publications of the Indian meteorological department. 8vo. London, 1889. 382 pp.

Blodget, Lorin. Climatology of the United States. 8vo. Philadelphia, 1857. 552 pp. 13 ch.

Brückner, Eduard. Klima-Schwankungen seit 1700, nebst, Bemerkungen über die Klima-Schwankungen der Diluvialzeit. (Extr.: Geog. Abh., Wien, Bd. IV, Heft 2.) 4to. Wien, 1890. 332 pp., 1 pl.

Hann, Julius. Handbuch der Klimatologie. 8vo. Stuttgart, 1883. 774 pp.

Hoffman, Herman. Phænologische Untersuchungen. 4to. Giessen, 1887. 82 pp., 7 tabl., 7 pl.

Woeikof, A. I. Die Klimate der Erde. 8vo. Jena, 1887. 396 pp., 11 pl.

Yeo, J. Burney. Climate and health resorts. 8vo. London, Paris, and Melbourne, 1890. 688 pp.

WEATHER FORECASTING.

Abbe, Cleveland. Preparatory studies for deductive methods in storm and weather predictions. Ann. Rep. Chief Signal Officer, 1889, part II. 8vo. Washington, 1889. 165 pp., 2 maps.

Abercromby, R. Principles of forecasting by means of weather charts. 2 ed. 8vo. London, 1885. 132 pp.

Bebber, W. J. Van. Die Wettervorhersage. Eine practische Anleitung zur Wettervorhersage. 8vo. Stuttgart, 1891. 183 pp.

Hazen, H. A. Weather forecasting at the Signal Office. Appendix No. 3, part 2, Rep. Chief Signal Officer, 1891.

Ley, C. Aids to the study and forecast of weather. 8vo. London, 1880. 38 pp., 2 pl.

Mascart, E. La météorologie appliquée à la prévision du temps. 12mo. Paris, 1881. 51 pp., 16 ch.

Scott, R. H. Weather charts and storm warnings. 3 ed. 8vo. London, 1887. 229 pp., 3 pl.

ATLASES, ETC.

Hann, Julius. Atlas der Meteorologie. (Berghaus's Phys. Atlas, Abteilung III.) 15 by 10 in. Gotha, 1887. 12 pp., 12 maps.

Hildebrandsson, Köppen, and Neumayer. Wolken-Atlas. Atlas des nuages. Cloud atlas. Moln-Atlas. 4to. Hamburg, 1890. 4 pp., 10 ch.

Hornberger, R. Grundriss der Meteorologie und Klimatologie, letztere mit besonderer Rücksicht auf Forst und Landwirte. 8vo. Berlin, 1891. 242 pp., 7 pl.

Teisserenc de Bort, Léon. Atlas de météorologie maritime, publié à l'occasion de l'Exposition Maritime Internationale du Havre. 12 by 9 in. Paris, 1887. 4to. 41 pp., 35 pl.

INSTRUCTIONS, TABLES, AIDS, ETC.

Abbe Cleveland. Treatise on meteorological apparatus and methods. Ann. Rep. Chief Signal Officer, 1887, pt. II. 8°. Wash., 1888. 388 pp., 36 pl.

Great Britain, Parliament. A manual of scientific inquiry. 5th ed. 8vo. London, 1886. 462 pp., 7 pl.

Hazen, H. A. Handbook of meteorological tables. 8vo. Washington, 1888. 127 pp.

Indian Meteorological Department. Indian meteorologists' vade mecum. Part I, Instructions; Part II, Meteorology of India; Part III, Tables for reduction of observations. 8vo. Calcutta, 1886; 1887.

London. Meteorological Council. Reports of the meetings of the international meteorological congresses and committees, 1872–1894. 8vo. London, 1873–1895.

Meyer, Hugo. Anleitung zur Bearbeitung meteorologischer Beobachtungen für die Klimatologie. 8vo. Berlin, 1891. 195 pp.

Paris. Comité Météorologique International. Tables météorologiques internationales publiées conformément à une décision du Congrés tenu à Rome en 1879. 4to. Paris, 1890. 522 pp.

Smithsonian Institution. Smithsonian meteorological tables. 8vo. Washington, 1893. 321 pp.

United States Weather Bureau. Instructions for voluntary observers, by T. Russell. 8vo. Washington, 1892. 100 pp.

United States Signal Service. Bibliography of Meteorology. A classed catalogue of the printed literature of meteorology. Part I, Temperature; Part II, Moisture; Part III, Winds; Part IV, Storms. 4to. Washington, 1889–1891.

CURRENT PERIODICALS DEVOTED ENTIRELY OR LARGELY TO METEOROLOGY.

American Meteorological Journal, Vols. I–XII, 1884–1895. (Monthly.) 8vo. Detroit, 1884–1885; Ann Arbor, 1885–1892; Boston, 1892–1895.

Annalen der Hydrographie und maritimen Meteorologie. Band I–XXIII, 1873–1895. (Monthly.) 8vo. Berlin, 1873–1895.

Annales du Bureau Central Météorologique de France. Mémoires, 1879–1893. 4to. Paris, 1880–1895.

Annali dell' Ufficio Centrale Meteorologico e Geodinamico Italiano. I–XV. Fol. Roma, 1880–1895.

Annuaire de la Société Météorologique de France. Vol. I–XLII. 8vo. Paris, 1853–1894.

Forschungen auf dem Gebiete der Agricultur-Physik. Hrsg. von Dr. E. Wolney. Band I, 1878–XVIII, 1895. (Five numbers per year.) 8vo. Heidelberg, 1887–1895.

Himmel und Erde. Illustrirte naturwissenschaftliche Monatsschrift. Gesellschaft Urania zu Berlin. Band I–VII, 1889–1895. 8vo. Berlin, 1889–1895.

Indian Meteorological Department. Indian meteorological memoirs, being occasional discussions and compilations of meteorological data relating to India and neighboring countries. Vols. I–VII. Fol. Calcutta, 1876–1895.

Journal of the Scottish Meteorological Society. Vols. I-X. 8vo. Edinburgh, 1856-1894.

Quarterly Journal of the Royal Meteorological Society. Vols. I-XXI, 1871-1895. 8vo. London, 1871-1895.

Meteorologische Zeitschrift. Band I-XI, 1884-1895. (Monthly.) 8vo. Berlin und Wien, 1884-1895.

Repertorium für Meteorologie. St. Petersburg. K. Akad. der Wissenschaften. Band I-XVII. 4to. St. Petersburg, 1870-1894. (Discontinued.)

Wetter (das), meteorologische Monatsschrift für Gebildete aller Stände. Hrsg. von R. Assmann. Band I-XII. 8vo. Magdeburg, 1885-1895. Braunschweig, 1887-1895.

Zeitschrift der österr. Gesellschaft für Meteorologie. Vols. I-XXV. 8vo. Wien, 1866-1885.

BOOKS OF REFERENCE.

Books of reference.

The following books of reference are, as a rule, furnished for station use:

Dictionary, Webster's Counting House; Meteorology, Moore; Meteorology, Davis; Physics, Daniel; Smithsonian Meteorological and Physical Tables; Treatise on Winds, Ferrel. (For further information relative to books that may be supplied stations consult form 1029, Appendix B.)

Distribution of publications.

When copies of reports or other books are sent to stations for distribution, preference must be given to public libraries, educational institutions, members of the meteorological committees, and scientific men. One copy of each report or book received must be kept permanently in the office for reference.

Results of investigations to be furnished.

All persons connected with the Weather Bureau are invited to furnish, for the benefit of the service, the results of investigations in meteorology. These contributions should treat of subjects germane to the work of the service, and when not published will be returned on application.

Publications for library.

Efforts should also be made by employees of the service to secure for the library of the central office a copy of any book or paper locally printed bearing upon meteorology or its applications.

FORECASTS.

Protection of interests injuriously affected.

The officials of the service on duty at the various stations will give special attention to those agricultural, commercial, and other property interests in their respective localities that are liable to be injuriously affected by unusually severe weather conditions, such as cold waves, frosts, heavy rains or snows, violent windstorms, etc., to the end that those interests may be protected as far as possible by timely warnings of the expected occurrence of the conditions mentioned.

Lists of property interests.

Officials in charge of stations will prepare lists of the superintendents of street railways, general managers of railroads, superintendents of railroad telegraph lines, and the managers of all other important interests in their vicinity of the classes referred to, to whom will be sent, by such means as in the judgment of the local official will secure the most prompt transmission of the information, such warnings as are especially useful to them. A copy of these lists will be transmitted to the central office and reports will also be made as to the location and character of the interests in their vicinity which are most liable to injury by particular weather conditions during the different seasons of the year, the object being to place information in the hands of the various official forecasters which will enable them at the proper season to make forecasts which will give the greatest protection to such interests as can be most benefited.

Copy of lists to be forwarded.

Dangerous conditions, when to advise of.

Officials in charge of stations, whenever at any time the weather conditions in their judgment indicate danger to those interests and warnings have not been received, are authorized to advise by telegraph to that effect the office at which the forecasts for that district are made.

Interests affected to be studied and warned.

The officials assigned to the duty of preparing the official forecasts for States and Territories, and those liable to such assignment, will thoroughly acquaint themselves with the respective interests before mentioned, and will be especially careful during their tours of duty as forecast officials to see that the sections in which they are located are effectively warned whenever conditions injurious to them are indicated. These officials will also familiarize themselves with the river systems in the territory forecasted for by them, so as to be able to make an accurate forecast of the movement of flood waves and of the stages of water at the different river stations in the event of threatened floods.

River systems.

Errors in publication of reports.

The official in charge is responsible for the correctness of all weather reports published at his station, and must take every precaution to guard against errors, especially in newspaper copy, where, owing to hasty composition, errors are most likely to occur. The accuracy of published reports must be verified by daily personal inspection; and when inaccuracies are found efforts made to trace them to the proper source and measures taken to prevent their repetition.

Headings to articles.

The managers of newspapers should be consulted and suggestions made to them as to appropriate headings and properly accrediting the data furnished, but employees will refrain from insisting upon or in

any way appearing to dictate a prescribed form. It should be urged, however, that the form adopted shall clearly convey the proper import of the information furnished, and that the exact wording of forecasts and special bulletins be followed.

Dissemination of reports.

The central office desires to impress upon all employees the importance to the public of a wide dissemination of weather information, and to that end all available local methods of distribution should be utilized. The press should receive special attention, and data furnished at such times and in such manner as will conform to the wishes of local managers and best subserve public interests.

Sensational reports to be avoided.

In announcing the probable occurrence of unusual meteorological conditions care must always be taken to avoid the circulation of sensational reports. While it is sometimes necessary to enlarge upon the information received by telegraph, officials should always be conservative in statements to the press and avoid expressing opinions tending to discredit the official predictions.

Unauthorized forecasts.

The publication of unauthorized forecasts is absolutely prohibited.

Counterfeiting weather forecasts.

"Any person who shall knowingly issue or publish any counterfeit weather forecasts or warnings of weather conditions, falsely representing such forecasts or warnings to have been issued or published by the Weather Bureau, United States Signal Service, or other branch of the Government service, shall be deemed guilty of a misdemeanor, and, on conviction thereof, for each offense, be fined a sum not exceeding five hundred dollars, or imprisoned not to exceed ninety days, or be both fined and imprisoned, in the discretion of the court." (Public, No. 177, approved August 8, 1894.) Violation of this law must be reported to this office.

Elements covered.

Forecasts of weather, temperature, and direction and force of wind for each State or part thereof are issued from the central office or some specially designated station at about 11 a. m. and 11 p. m., seventy-fifth meridian time, daily.

These forecasts are furnished the press associations and are telegraphed to outlying stations.

Meaning of terms "Fair," etc.

In forecasting weather, the term "Fair" is used to indicate that no precipitation in excess of 0.01 of an inch is anticipated; "Rain" or "Snow," with any modifying terms, that precipitation will occur over the whole of the area forecasted for.

In forecasts of temperature, the term "Warmer" indicates that the temperature at the observation at the end of the period forecasted for will be higher than at the observation twenty-four hours previous; "Colder," that it will be lower; "Stationary," that the twenty-four-hour changes at the end of the period forecasted for will not be greater than 8°. An omission to forecast temperature will be considered as equivalent to a forecast of stationary temperature.

Period covered.

Morning forecasts will, as a rule, cover a period of twenty-four hours, ending at 8 p. m. of the following day, although forecasts may be made for the current day when it is expected that decided changes will occur.

Forecasts for longer periods will be made only when the conditions fully justify such action.

Night forecasts (when authorized) will cover twenty-four hours from 12 midnight following the reports upon which they are based.

Day of the week to be named.

The day of the week should usually be named to designate the period within which the conditions forecasted are expected to occur; the time between 8 a. m. and 8 p. m. will be referred to by the name

of the day as "Monday," and the twelve hours between 8 p. m. and 8 a. m., by the name of the night, as "Monday night;" a forecast made from the 8 a. m. observations of Monday, "Fair until Wednesday," covers the forty-eight hours ending 8 a. m. Wednesday, etc., the day ending at 8 p. m., and the night, when named, ending at 8 a. m.

Doubtful conditions.

In cases where the official is in doubt, the forecasts should state that the weather conditions are unsettled. Ambiguous expressions must be avoided.

Climatology of the section.

All officials charged with the important duty of forecasting should carefully study the climatology of their respective stations, not only to aid them in forecasting, but with a view of publishing the results for the information of the general public. They will note and revise, when necessary, the rules which guide them in making forecasts.

Interests and industries of the locality.

The interests and industries of each locality should also be studied in order that local needs may be covered as fully as possible, and particular attention should be given to the forecasts on occasions of popular assemblages. If necessary, requests for special forecasts from the central office or other center should be made four or five days in advance of the date on which they are desired.

Local forecasts.

In addition to the forecasts made at the central office, and the other specially designated centers, local forecast officials and others have been authorized to make forecasts for their respective stations and the territory immediately surrounding. The elements forecasted are the same as those named in the opening paragraph of this chapter. As a rule local forecasts will be made from the morning maps.

Distribution of forecasts.

Whenever practicable forecasts will be furnished to railroads, telegraph, and telephone companies who agree to post them at the offices on their lines without expense to the United States. Blank bulletins and frames in which to display them will be furnished as far as the appropriation for their purchase will admit.

Notifications of heavy rainfall.

When telegrams announcing the probable occurrence of heavy rainfalls likely to produce floods, severe local storms, etc., are received, the greatest publicity will be given the warnings, always being careful to frame the warnings so as to avoid sensational features.

Report as to distribution, damage, etc.

After the storm has passed, a report of the action taken, accompanied by copies of bulletins and clippings from newspapers (see paragraph as to clippings), will be forwarded to the central office.

Copy to be forwarded.

A copy of each forecast must be mailed to the central office, with the time at which it was made noted thereon.

Verification of forecasts.

Official verification of forecasts will be made at the central office only.

Maps for study.

Observers making a local forecast must make a pencil map for study exactly the same as the weather map used in the forecast division at the central office, except that it may be made on the form used for printing the milleograph map.

Authority to forecast.

Officials at lake or seacoast stations not at present authorized to make forecasts, but who may feel confident of their ability to forecast the direction and force of the wind for their respective vicinities, may request authority to do so.

Signal systems for disseminating forecasts.

As a further means of disseminating the daily forecasts, the following signal systems have been adopted, viz: Wind; inland storms; weather and temperature; frost warning and cold wave.

Flags and lanterns. At stations on the sea, gulf, and lake coasts the expected approach of winds dangerous to shipping is announced by the display of flags and pennants by day and lanterns by night, except that on the Pacific Coast night signals are not displayed.

Orders to be sent from. Orders for the display of signals are sent from the central office or some specially designated station.

Duties in connection therewith. The duties in connection with the display of signals consist in hoisting and lowering the proper flags in compliance with telegraphic instructions, or as hereinafter provided for, and the distribution of the information concerning the storm to all interested persons.

The wind-signal system consists of storm, information, and hurricane signals.

Storm signal. The storm signal is a red flag with a black square in the center. It indicates that a storm of marked violence is expected.

Pennants used. The pennants displayed with the flag indicate the direction of the wind—the red, easterly (from northeast to south), and white, westerly (from southwest to north). The pennant hoisted above the flag indicates that the wind is expected from the northerly quadrant; below, from the southerly quadrant.

Information signal. The information signal, red or white pennant, displayed alone, at stations on the Great Lakes, indicates that winds are expected at the station displaying the signal which may prove dangerous to small vessels and tows, without reference to any stated velocity. A red pennant indicates easterly winds, and a white pennant, westerly winds. The white pennant will not be displayed alone at stations on the sea or gulf coast.

Information can be obtained. The red pennant (information signal) displayed at stations on the Atlantic, Pacific, and Gulf coasts indicates that the local official has received information from the central office of a storm covering a limited area, dangerous only for vessels about to sail to certain points.

The signal serves as a notification to shipmasters that information will be given them upon application to the local official.

Hurricane signal. The hurricane signal consists of two red flags with black centers, displayed one above the other, and will be used to announce the expected approach of tropical hurricanes, and also of those extremely severe and dangerous storms which occasionally move across the lakes and the northern Atlantic coast.

Night signal displayed. The flags are the same as used for the distinctive storm signal, the pennants being omitted. No distinctive night hurricane signal will be displayed, but when this signal is ordered during the day and is not lowered or changed before dark, the night storm signal will be displaced, the direction to be determined by the information contained in the message accompanying the order to hoist.

Warnings to be distributed. Whenever orders to hoist this signal are received at any Weather Bureau station, every effort must be made by the officials and employees of the service to give the warnings the widest possible distribution, and all vessels must be notified that it is dangerous to leave port.

Cooperation of other services. The officers of the Customs Service, the Life-Saving Service, the Revenue-Cutter Service, and the Light-House Service have been directed by the Secretary of the Treasury to assist the Weather Bureau in this matter by displaying the hurricane signal and by disseminating, so far as practicable, any information regarding storms and hurricanes that may be furnished them by this Bureau. The flags for use in this connection will be furnished by the Bureau.

Officials in charge of regular and wind-signal display stations will communicate with such of these officers as may be stationed in their vicinity and arrange for their effective cooperation in the carrying out of the above instructions.

Verifying velocities.

The following are the justifying velocities for stations on the Atlantic and Gulf coasts:

Gulf and Atlantic coasts.

Stations.	Easterly winds with temperature above freezing, and westerly winds with freezing temperature.	Easterly winds with freezing temperature.	Westerly winds with temperature above freezing.
	Miles.	*Miles.*	*Miles.*
Corpus Christi	32 and upward	29 and upward	35 and upward.
Galveston	29 and upward	26 and upward	32 and upward.
New Orleans	26 and upward	23 and upward	29 and upward.
Mobile	29 and upward	26 and upward	32 and upward.
Pensacola	27 and upward	24 and upward	30 and upward.
Tampa	26 and upward	23 and upward	29 and upward.
Key West	30 and upward	27 and upward	33 and upward.
Jupiter	31 and upward	28 and upward	34 and upward.
Jacksonville	29 and upward	26 and upward	32 and upward.
Savannah	29 and upward	26 and upward	32 and upward.
Charleston	29 and upward	26 and upward	32 and upward.
Wilmington, N. C.	26 and upward	23 and upward	30 and upward.
Southport	30 and upward	27 and upward	32 and upward.
Hatteras	32 and upward	29 and upward	35 and upward.
Kitty Hawk	32 and upward	29 and upward	35 and upward.
Cape Henry	32 and upward	29 and upward	35 and upward.
Norfolk	23 and upward	21 and upward	27 and upward.
Baltimore	22 and upward	19 and upward	25 and upward.
Delaware Breakwater	32 and upward	29 and upward	35 and upward.
Atlantic City	27 and upward	23 and upward	29 and upward.
Sandy Hook	32 and upward	29 and upward	35 and upward.
New York	30 and upward	27 and upward	35 and upward.
New Haven	27 and upward	23 and upward	29 and upward.
New London	25 and upward	23 and upward	28 and upward.
Block Island	32 and upward	29 and upward	35 and upward.
Woods Holl	30 and upward	27 and upward	33 and upward.
Nantucket	28 and upward	25 and upward	31 and upward.
Boston	30 and upward	27 and upward	33 and upward.
Portland, Me	25 and upward	27 and upward	33 and upward.
Eastport	30 and upward	27 and upward	33 and upward.

Great Lakes.

The following are the velocities required to justify signals at stations on the Great Lakes:

Stations	Winds with temperature above freezing.	Winds with freezing temperature.
	Miles.	*Miles.*
Duluth	26	24
Marquette	31	28
Sault Ste. Marie	24	22
Green Bay	31	26
Milwaukee	35	32
Chicago	40	37
Grand Haven	35	32
Alpena	30	27
Port Huron	35	32
Detroit	34	30
Toledo	30	27
Sandusky	35	32
Cleveland	32	29
Erie	33	30
Buffalo	35	32
Rochester	31	28
Oswego	33	30

Classes of stations. There are two classes of wind-signal display stations, viz: Regular meteorological stations in charge of officials of the Bureau and special display stations in charge of wind-signal displaymen.

Section centers. For the purpose of obtaining prompt communication by mail and telegraph and to relieve the central office of the routine duties in connection with the management of the wind-signal display stations, they are grouped in sections and each section is placed under the control of an official at a Weather Bureau station, which is designated the section center.

Instructions to special displaymen. Full instructions for the guidance of wind-signal displaymen will be found in the pamphlet entitled Instructions to Special (wind signal) Displaymen of the Weather Bureau.

Orders, where sent from. Orders to display signals at stations in a section are sent to the official in charge of the section, who repeats them to the displaymen; or they may be sent direct from headquarters.

Evening messages, how treated. When messages relating to the hoisting or lowering of signals at wind-signal display stations are received at the regular Weather Bureau stations too late in the evening to be repeated to the display stations before the close of their telegraph offices for the night, the messages will not be filed for transmission unless they end with the word "urgent." When messages are received and held under these instructions, officials will be especially vigilant on the following morning, and if the conditions still indicate the display of signals at the display station will order them at the earliest practicable moment, carrying out the instructions hereinafter given. But forecast officials will usually order night signals before 6 p. m., making use of their authority to call for special observations late in the afternoon when they have reason to believe that night signals will be needed.

Description of message. Orders to hoist "Storm signals" will be telegraphed "Storm southwest 10.30 a. m.," and the message will contain such further information as may be necessary; orders to hoist "Information signal" to stations on the Great Lakes will indicate the expected direction of the wind, whether easterly or westerly, while in those to stations on the Gulf and sea coasts the expected directions will be omitted. Orders to change storm signals will be sent in the words "Change to northwest 10.30 a. m.," etc. Orders to continue signals will be sent "Continue signals 10.30 a. m.," etc.

Signals down. Orders to lower signals will be issued in the words "Signals down."

Explanatory statement. The forecast official will send with the order to hoist, and as often during the display as he may consider necessary and practicable, a brief statement giving the location of the storm center and the probable direction in which it will move; the probable direction of the wind at the station in the next eight or sixteen hours and the probable direction in which it will shift; the probable state of weather in next twelve or twenty-four hours, whether rain, snow, or fog is expected and whether higher or lower temperature and the probable time the storm will cease.

Distribution. These telegraphic notifications will be given the widest possible distribution by bulletins and newspaper reports.

Time signal is to be displayed. Whenever a signal is ordered at a station it will be displayed at the time specified in the telegram conveying the order, and will remain displayed twenty-four hours, and no more, unless changed, continued, or lowered before the expiration of that time. Signals continued will likewise be displayed for twenty-four hours, subject to the same provisions as those first hoisted. Each display of twenty-four hours, or

a fraction thereof, will be considered and treated as a separate signal. At the end of the twenty-four hours for which the signal is displayed, or on receipt of a telegram to lower the signal, the officials before lowering the signals will assure themselves that the velocity of the wind for one hour previous has been at least 4 miles below the minimum velocity required to justify the signal in question.

Officials authorized to hoist signals.

Whenever, except between 8 and 11 a. m. and p. m., the conditions in the vicinity of any station on the Great Lakes or the Atlantic or Gulf coast indicate, in the judgment of the official in charge, the occurrence within eight or twelve hours of winds of a verifying velocity (no signal being then displayed at his station), he is authorized to advise the office from which he receives orders by telegraph of the fact by sending a message giving briefly the word "signals."

Officials specially authorized to hoist signals.

Whenever, between 5 p. m. and 10 p. m., and midnight and 10 a. m., and on Sundays and legal holidays, the conditions at any station included in the foregoing paragraph very strongly indicate, in the judgment of the official in charge, the occurrence within four or six hours of winds of a verifying velocity, he is authorized to hoist signals, notifying the office from which he receives orders immediately by telegraph of his action. These messages will give the kind of signal and time of hoisting and reasons in brief for such action. The official in charge may also, within these hours and on those days, change the direction of or continue signals when in his judgment the conditions strongly indicate such action, reporting the fact immediately by telegraph to the central office.

Length of display.

The same rules as to the length of the display will apply to these signals as to those ordered by the official at the office whence they receive orders.

Great caution to be exercised.

Officials will exercise the greatest caution in displaying signals under these authorities, remembering that they are given them not that they may use them regardless of the judgment of the forecast official, but rather that they may give warning of the approach of storms whose rapidity of progress or development is much greater than is indicated by regular observations.

When signals have been hoisted and order for signals is received.

When an official has hoisted signals at his station or ordered up signals in his section, and later receives an order for signals at his station or in his section differing from those hoisted by the official *only as to direction* and the difference is not more than 90 °, he will use his own discretion in the matter of changing the signals already up.

Order preceded by words "notification received."

If the order is preceded by the words "notification received," the official will understand that his notification that he has ordered signals has been received, and will change the signals accordingly, without regard to the preceding paragraph.

Signals lowered.

Officials are authorized to lower signals at any time when in their judgment the conditions clearly indicate that the winds will be no longer dangerous, reporting their action by telegraph to the office from which they receive orders. In the exercise of this authority they will be very careful not only that the signals are not displayed longer than they are actually needed, but also not to lower them on insufficient information.

Special observation to be taken, etc.

When signals are hoisted or lowered in the exercise of his own discretion by an official at a station, if the time be more than two hours after an observation which has been telegraphed, a special observation will be taken and telegraphed with the notification.

Verification. The verification of forecasts of wind will be confined to the verification of the display of storm signals.

Conditions considered. The justification of wind signals at each station will be determined by a consideration of the conditions occurring within a radius of 150 miles of the station.

Verifying velocities furnished. Stations on the Lakes and Atlantic and Gulf coasts are furnished the velocities that should justify a storm signal under certain conditions.

When the display ceases on lakes. The display of wind signals on the lakes ceases with the close of navigation in winter and is resumed in the spring, except in special cases; officials should therefore confer with those at their stations most interested in lake navigation and report the probable dates for discontinuing and resuming signals each season.

Publication of same. The dates of suspension and resumption of signals will be published with the forecasts issued from the central office.

Equipment. Each station should be supplied with two storm flags and three red and three white pennants.

Flagstaff. The staff should be located, if practicable, on the roof of the office building, equipped with *two* sets of halliards, and the flags should be plainly visible from all parts of the harbor or navigable waters for at least 3 miles; if this is not the case officials should endeavor to hav the signals duplicated at a point from which they can be seen for the distance named.

Duplication of signals.

Care of flags, etc. The signal flags and lanterns should, after each display, be placed in readiness for the next display.

Second staff for cold-wave flag. Officials at wind-signal stations where the cold-wave flag is displayed should endeavor to obtain the use of a second staff for the cold-wave display, in order to prevent making both hoists from the same staff at the same time.

Competency of new official. When a new official takes charge of the wind-signal station he should report whether or not he considers himself competent to hoist, lower, change the direction of, or continue wind-signal displays on his own authority, as hereinbefore provided.

THE INLAND STORM SIGNAL.

Description. The inland storm signal, red flag with a black square in the center, will be displayed in the States of North and South Dakota, Minnesota (except at lake stations), Iowa, Nebraska, and Wyoming, to give warning of the approach of the storm sometimes called a "blizzard," or *storms with high winds, accompanied by snow, with temperature below freezing*. The term "blizzard," however, should not be used in giving notice of these storms.

Hoisting and lowering the signal. The warning will usualy be twenty-four hours in advance of the expected storm, and will be telegraphed to all stations in the locality likely to be affected. The telegram announcing the approach of this storm will state the time at which the flag should be hoisted, and it will be lowered at the expiration of twenty-four hours from that time, unless orders are received to lower it sooner or to continue the display. If the storm occurs as predicted the flag may be lowered as soon as, in the judgment of the official or displayman, the violence of the storm is over.

Distribution. Officials charged with the dissemination of the forecasts and warnings to forecast displaymen will, upon receipt of an inland storm warning, telegraph it at once to all on their lists in the region to be affected.

It is not intended that the inland storm signal shall replace the cold-wave signal; both will be used as occasion may require, and both will be verified alike by the decline of temperature. Inland storm signal not to replace the cold-wave signal.

WEATHER AND TEMPERATURE SIGNALS.

These signals are displayed at the regular and special stations and represent the forecasts telegraphed from Washington or other center or those made at the station. Explanation.

The system consists of the following flags: System.

A white flag to indicate "clear or fair weather;" a blue flag, "rain or snow;" a flag the upper half of which is white and the lower half blue, in horizontal bars, "local rain or snow." Weather.

A black triangular pennant is used to indicate the "temperature." Temperature.

The temperature pennant hoisted *above* a weather flag indicates "higher temperature;" below, "lower temperature." It is never displayed alone. Absence of the pennant indicates "stationary temperature." Higher or lower.

The cold-wave flag may also be used in connection with weather and temperature signals. Cold-wave flag.

A red pennant (information signal at lake and seacoast stations) is used to indicate hot northerly winds in the Sacramento and San Joaquin valleys, in California, for the benefit of the fruit interests of that section. Hot northerly winds.

DISPLAY OF WEATHER AND TEMPERATURE SIGNALS AND DISTRIBUTION OF COLD-WAVE AND FROST WARNINGS.

The morning forecasts cover the thirty-six-hour period ending at 8 p. m. following the day of issue, and the flags displayed should, as far as practicable, represent only the forecast applying to the last twenty-four hours of the period named. Period covered by flag displays.

If more than one kind of weather is predicted for the period from 8 p. m. to 8 p. m., the conditions first named in the forecast will be represented by the uppermost weather flag in a vertical hoist, or by the weather flag nearest to the small streamer indicating the point, in a horizontal hoist, from which the signals are to be read. Arrangement of flags in display.

When a warning of a "Cold wave" is included in the forecast message, the cold-wave flag will be displayed below the proper weather flag, and warnings distributed to such stations as may have been authorized to receive this information by telegraph, but if the forecasts contain an announcement of "Moderate cold-wave" for any section, the cold-wave flag will not be displayed in that section. If frosts are predicted, the warning will be distributed to stations authorized to receive such information, without waiting for further orders. Cold-wave flag to be displayed when warning of cold wave is included in forecast message.

Weather and temperature signals are also communicated by means of whistles, explained, as follows: Whistle signals.

The warning signal, to attract attention, will be a long blast of from fifteen to twenty seconds' duration. After this warning signal has been sounded long blasts (of from four to six seconds' duration) refer to weather, and short blasts (of from one to three seconds' duration) refer to temperature; those for weather to be sounded first. Number of blasts.

Blasts.	Indicate.
One long	Fair weather.
Two long	Rain or snow.
Three long	Local rains.
One short	Lower temperature.
Two short	Higher temperature.
Three short	Cold wave.

Not blown by locomotive engineers.

It is not intended that the weather signals should be blown by locomotive engineers, as the railroads have similar whistle signals for their own purposes, and for obvious reasons could not use those of the Weather Bureau.

FROST WARNINGS.

Flag displayed. Territory.

In Florida and over a strip of territory about 100 miles wide paralleling the Gulf Coast in Alabama, Mississippi, Louisiana, and Texas, and along the Pacific Coast, the frost flag—the cold-wave flag of other localities—is displayed whenever a frost injurious to vegetables and staple products is expected. In other sections the flag is displayed in the early autumn and late spring, but not during the cold-wave season. Information as to the probable occurrence of light or heavy frost is also given in the daily forecasts, and the warnings are distributed by telegraph and telephone.

COLD-WAVE SIGNAL.

Flag.

The Weather Bureau cold-wave flag (white flag with a black square in center) is displayed when an unusual fall in temperature and to near or below freezing, independent of the diurnal range, is anticipated.

Limits defined during winter.

During the months of December, January, and February cold-wave signals will be ordered whenever in the judgment of the forecast official the following temperature falls are indicated in the districts named, the temperature at the observation on which the order is based being above 40°, viz: North of Arkansas and between the Mississippi River and the Rocky Mountains (including Minnesota), a fall in twenty-four hours of 18° and to 26° or below; in thirty-six hours of 22° and to 26° or below; or in forty-eight hours of 26° and to 26° or below. North of Tennessee and North Carolina and east of the Mississippi River (including St. Louis), a fall in twenty-four hours of 16° and to 30° or below; in thirty-six hours of 20° and to 30° or below. In all other districts east of the Rocky Mountains, except along the Gulf Coast and in Florida, a fall in twenty-four hours of 16° and to 34° or below; in thirty-six hours of 20° and to 34° or below; or in forty-eight hours of 24° and to 34° or below. Along the Gulf Coast and in Florida, a fall in twenty-four hours of 16° and to 36° or below; in thirty-six hours of 20° and to 36° or below; or in forty-eight hours of 24° and to 36° or below.

During other months.

During all other months, when the temperature at the time of the observation is above 40°, signals will be ordered for the following falls, viz: North of Arkansas and between the Rocky Mountains and the Mississippi River (including Minnesota), a fall in twenty-four hours of 18° and to 32° or below; in thirty-six hours of 22° and to 32° or below; or in forty-eight hours of 26° and to 32° or below. North of Tennessee and North Carolina and east of the Mississippi River (including St. Louis), a fall in twenty-four hours of 16° and to 36° or below; in thirty-six hours of 20° and to 36° or below; or in forty-eight hours of 24° and to 36° or below. In all other districts east of the Rocky Mountains, except along the Gulf Coast and in

Florida, a fall in twenty-four hours of 16° and to 40° or below; in thirty-six hours of 20° and to 40° or below; or in forty-eight hours of 24° and to 40° or below. Along the Gulf Coast and in Florida, a fall in twenty-four hours of 16° and to 42° or below; in thirty-six hours of 20° and to 42° or below; or in forty-eight hours of 24° and to 42° or below.

When the temperature is 40° or below.

When the temperature at the time of the observation on which the order is based is at 40° or below, signals will be ordered for the same twenty-four-hour falls, or when thirty-six-hour falls of 2° less, or forty-eight-hour falls of 4° less than, and to the same limit as, those hereinbefore specified are indicated.

Cold waves without signals.

When signals are not ordered and twenty-four-hour falls of 4° more than the first limit and to 4° below the second limit herein specified occur, such falls will be considered as cold waves without signals.

Diurnal variation.

In determining the thirty-six-hour fall the diurnal variation will be disregarded.

Twenty-four hour, etc., falls, temperatures to be considered.

In determining the twenty-four and forty-eight hour falls, and the occurrence of cold waves without signals, the difference between the maximum and minimum temperatures for the consecutive days will be considered.

When signal is justified.

If the required twenty-four-hour fall occurs within thirty-six hours after the signal is ordered, the signal will be considered justified.

Period covered.

Cold-wave warnings will usually be for a period of twenty-four hours from the time of the map on which the warning is based, 8 a. m. or 8 p. m., as the case may be. Warnings for longer periods than twenty-four hours will only be for very pronounced types of cold waves.

Language used in message.

Orders to hoist cold-wave signals will be sent about in the following terms: "Cold wave, fall 16 to 20 degrees Monday morning," meaning "Hoist cold-wave signals, the temperature will fall from 16 to 20 degrees by Monday morning." In repeating this order to the regular Weather Bureau stations the abbreviated message will be used, but in furnishing the information to the public and to the press it will be written out in full.

Hoisting and lowering the flag.

When, in the opinion of the official in charge of the station, it is evident the lowest temperature has occurred before the receipt of the cold-wave signal the flag will not be hoisted, and the official will notify the point from which orders are received, by telegraph, of the fact.

Flags to be lowered.

Officials in charge of stations are also authorized to lower the cold-wave flag as soon as it is evident that the lowest temperature has occurred.

EMERGENCY WARNINGS.

Tropical hurricanes, storms, etc.

When a tropical hurricane, storm, or cold wave of extreme severity is indicated for any portion of the United States east of the Rocky Mountains, the official in charge of the preparation of forecasts at the central office will send special warnings to officials in the threatened districts. These warnings will be known as emergency warnings, and will always end with or contain the words "NOTIFY POSTMASTERS."

To postmasters.

Officials of the Bureau receiving these warnings should transmit them without delay and at the expense of the United States to postmasters in accordance with the prearranged plan.

Others interested.

In addition to sending the warnings to postmasters, all other available means should be employed to disseminate the information as

widely as possible. Vessels lying at anchor in the harbor and outlying points that can not be reached by telegraph or telephone should be notified if possible.

Distribution. Postmasters receiving emergency warnings have been instructed to give them the widest possible circulation. (See August, 1894, Supplement to the Official Postal Guide.)

Reasonable expense to be incurred. When the storm is expected to be of marked violence the warning message will contain instructions to incur reasonable expense in the distribution of the information contained therein. In the latter event

Use of tugs authorized. tugs, special messengers, etc., may be employed to notify the planters and others occupying isolated and dangerous points.

Report of benefits, etc. When the storm has passed a report will be made concerning the benefits that may have resulted from heeding the warnings in the immediate vicinity of the station and also at the separate points to which the warnings were sent.

WEST INDIA SERVICE.

Hurricane season. During the hurricane season, from July 15 to October 15, the Bureau maintains stations at several places in the West Indies at a nominal expense, and also receives reports from several others through the courtesy of the maritime meteorological service and the authorities of Belen College, Havana, Cuba.

Time of observations. The observations at West Indian stations are taken at 7.15 a. m. and 5 p. m., seventy-fifth meridian time. When it is necessary an earlier hour may be designated, so that the reports may reach the United States before the cable office closes.

Telegraphed. The reports from these stations are telegraphed to the official at Key West, Fla., whenever an unusual meteorological disturbance occurs or information is received of an approaching storm, either at the time of the regular observation or during the interval between observations.

When telegraphed during interim of season. From October 15 to July 15 regular observations are not taken, but in case of an approaching hurricane observations are authorized, and when taken are telegraphed to the official at Key West, Fla.

Payment for messages. The Department will be responsible to the telegraph company for payment of cost of messages.

Daily journal to be kept. A daily journal is also kept at these stations, in which the general meteorological conditions from day to day and a description of any unusual atmospheric disturbances or severe storms are noted. Barometer readings should be made at frequent intervals during the prevalence of a severe storm.

When forwarded. The journal, with copies of the telegrams sent during the month, should be forwarded by mail to the Chief of Weather Bureau, Washington, D. C., at the close of each month.

When reports are telegraphed to Washington. The official at Key West telegraphs the reports to Washington and to other specially designated stations.

Daily reports from Havana. Morning observations are received daily at Key West from Havana, but the official forwards them only when in his opinion the information is of sufficient importance to warrant the expense.

Reports from Nassau. Through the courtesy of the Governor of the Bahamas, daily weather reports are received by the official at Jupiter, Fla., from Nassau, New Providence.

Reports from Yucatan. Reports are also received from Merida, Yucatan, during the hurricane season, whenever threatening weather conditions are observed.

Reports of ocean swells, etc. In connection with the hurricane service, arrangements have been made whereby the keepers of the life-saving stations and light-houses

on the Atlantic and Gulf coasts report between June and November of each year any premonitions of advancing hurricanes, such as heavy ocean swells, observed by them.

Phenomena preceding hurricanes.

During this period officials in charge of Atlantic and Gulf coast stations will give special attention to the characteristic phenomena which precede hurricanes. When, by the appearance of the sky or the occurrence of extraordinarily high tides or storm waves, there is an indication of the approach of such a storm, a special observation will be taken and sent, together with a brief description of the phenomena. If the signs increase or continue six hours or more after the first report, additional reports should be sent. When the ocean swell is reported, the character and direction from which moving should be given.

Premonitory signs, etc.

A study of the premonitory signs of hurricanes will be made from such books and records as are available.

The following article is published for the information of all concerned:

CHARACTERISTIC PHENOMENA OF TROPICAL CYCLONES, OR WEST INDIAN HURRICANES, BY P. BENITO VINES, S. J.

[Translated from the Spanish.]

Decomposition of the solar light in the high atmospheric regions, *reddish colors.*

In a measure, as the barometer in its decided and continued fall announces the approach of the hurricane, and long before the cirro-stratus appears, there is a notable change observed in the atmospheric regions. The higher layers lose their extreme transparency and the blue of the sky is not so pure as before. A thin veil, scarcely visible, covers the celestial arch, and it darkens by degrees. This hazy veil has the property of decomposing rapidly the solar light, giving passage in preference to the red, and absorbing almost entirely the remaining rays, whenever these solar rays, striking obliquely, are compelled to cross a large portion of the atmosphere. From this decomposition of the light there arises during this phase a singular and characteristic appearance of the sky during the rising and setting of the sun.

The atmosphere in the upper regions takes on such occasions a uniform reddish tint, which covers the whole hemisphere, and during the twilight and while the crepuscular rays are fading, merges into the dark red and somewhat violet color, which color remains a long time after sunset, as if this dim and prophetic light tried to prolong the evil omen in the longer duration of the twilight.

The heads of the cumulus and strato-cumulus appear crowned with vivid and dazzling reflections, the violet color predominating at the base; objects appear colored with flaming reflections, and the sky presents, as a whole, magnificent contrasts and beautiful pictures impossible to describe. Later, at the time when the cirro-stratus begins to appear and the opaline veil becomes each moment more defined and transformed by degrees into a milky semitransparent veil, these reddish tints take a character somewhat alarming as they obscure the sun, the whole atmosphere then simulating the glowing reflections of an aurora borealis, which resemble an immense fire; and while the sun is dropping toward the horizon the colors gradually diminish in vividness, and I should compare them in this case to the dark-red color of incandescent metal. The heavens acquire at this moment an appearance truly threatening, and foreboding evil. These characteristic tinges have been compared by some authors to red copper colors and by others to red brick dust.

This phenomenon, as it is seen, is a constitutional physical result of the hurricane, a characteristic phenomenon, and as such it is never missing, nor can ever be missing in a hurricane, and in a greater or less degree will also be observed in whirlwinds at various points of the globe and in very different latitudes, so that there can hardly be found a meteorological author who does not attempt a description of this phase.

RIVER SERVICE.

Classes. River stations are divided into two classes, viz, regular stations of the Bureau, where an observation of the height of water in the river is made at the time of the regular morning observation, and special stations, where a single observation is made as described in "Instructions to Special River Observers of the Weather Bureau."

River gauges. The "Instructions" above named contain a description of the gauges in use at the several stations of the Bureau.

Ownership of gauges. River guages are constructed at the expense of the United States, except where there is a gauge in existence the property of the municipality, county, township, or corporation, in which case no gauge will be erected if permission can be obtained to use the one already established.

Duplication of gauges. Duplication of gauges should be avoided when possible, both in the interest of economy and to save the confusion that would naturally arise from two records at a single place. It is preferable that the gauge be owned by the citizens of the vicinity, whose interest in the matter would doubtless secure its preservation.

Zero of gauge. It is not always possible at the time of setting a gauge to put the zero of the graduations at the exact level of the lowest water apt to occur.

Stage below zero. When a stage of water below the zero occurs it is read as a minus stage. It is desirable that the zero be put so low that this will never occur, as the minus sign is apt to lead to confusion; yet it is advisable not to get the zero too low.

Change in the zero. After a gauge has been established and a long record of readings has been made it is not advisable to change the zero on any pretext, even if a stage should occur lower than any ever before known.

Bench mark. For the purpose of determining from time to time whether any changes have occurred in the level of the zero of a gauge or any of its marks, a bench mark should be established close by the gauge or somewhere in its immediate vicinity. A bench mark is simply some one point in a line of precise levels whose elevation is known.

Height of zero. The difference in level between the bench mark selected and the zero of the gauge should be determined by precise leveling, and the result communicated to the central office and also placed on record at the station.

Location of bench mark. A bench mark is essential in case a river gauge is to be repaired or renewed, in order to set the new gauge at exactly the previous level. On a bridge pier the upper surface of the largest stone accessible in the top course of masonry is often used as a bench mark. Sometimes a bench mark is the top surface of a large stone buried in the ground specially for the purpose of establishing a permanent surface. Prominent surfaces in stone buildings are good places for permanent bench marks. A copper bolt set in the stone wall of some public building, such as a custom-house, post-office, or city hall, is a common device for a bench mark in a large city.

Observation.

The height of water surface on the gauge should be noted to the nearest tenth of a foot each day, including Sundays and holidays. This can only be done accurately in case the water is placid; in a rough or turbulent stream, or when there is much wind, the waves prevent an accurate reading. In such a case the tenths must be estimated as accurately as possible by taking the average of the highest and lowest points on the gauge which the water is seen to touch.

Floating ice, timber, etc.

Any unusual occurrences connected with the stage of the water in the river, such as the presence of floating ice, timber, etc., formation and breaking up of ice gorges and other obstructions, also thunderstorms, hailstorms, tornadoes, and earthquakes, should be recorded for future reference.

Time of observation.

The observation of river stage will be made daily at 8 a. m., seventy-fifth meridian time, except when otherwise directed.

At an earlier hour.

There is no objection to making the observation fifteen minutes or half an hour earlier when it is a question of catching some particular mail by which the observation is sent.

At a later hour.

In some cases the observation is authorized to be made later, where a telegraph office is not opened and there is nothing gained by filing the message at an earlier time.

The observation also may be made later at some stations at certain seasons of the year, when there is not sufficient light to permit of reading the gauge earlier.

Seventy-fifth meridian time to be used.

In all cases the hour of observation should be given in seventy-fifth meridian time in the proper space at the head of Form 1006–Metl.

Minus sign.

When the stage is below the zero of the gauge it will be recorded in the form with a minus (—) sign before it.

Special observations.

Special observations of the stage of water will be made at other hours when there is a request for them or when the river is at a critical stage.

During great rises.

It is desirable to have a special observation of the highest stage reached by the water in the case of very great rises.

When dangerous to points below.

When the rise in a river is very sudden and great, and, in the judgment of the official, dangerous to points below, the stage will be telegraphed to the center, or to the place most interested in such information.

Data to be given.

Special observations will consist of exactly the same information as that contained in a regular observation.

Postal card, when mailed.

A postal card conveying only a record of the daily stages of water in the river should be mailed each month to the central office.

Instructions for telegraphing.

Full instructions for telegraphing river observations will be found in the Weather Code, together with the cipher words to be used in transmitting the report.

Districts.

For the purpose of forecasting the river changes, floods, etc., the rivers of the country have been divided into districts, each in charge of an official at a central station. Officials assigned to the charge of these districts will prepare themselves, by a careful study of all the data available, to make as accurate forecasts as possible of the daily changes, and, in the case of floods, of the probable stages of the rivers in their districts. In the event of threatening floods every effort will be made to warn all persons and interests exposed to danger.

THE USE OF THE MILLIOGRAPH AND THE PROCESS OF MAP MAKING.

Care and preparation of the zinc plate.

Keep the zinc plate smooth and clean, to insure a free and easy movement of the pen. It may be polished by rubbing with pumice stone or fine emery paper. A few drops of oil rubbed on the plate with a

piece of soft paper will take off the paraffin that adheres to it from the use of the stencil paper.

How to enter names on zinc plate.

Place a piece of carbon paper on the zinc, and on the former lay a map face up; then with a hard pencil or stylus register the map by drawing lines at right angles along the top and sides. Dot the stations from which reports are received and draw short lines where the data for each station are to be entered, taking care to place such lines where the data will not obscure the names of adjoining stations on the printed map. Initials or abbreviations of the names of stations may be recorded on the bedplate as a guide in entering data. Lines for precipitation, synopsis, forecasts, and local data should be drawn about three-sixteenths of an inch apart when these data are entered with the pen. Upon removal of the map and carbon paper the transfer will show on the zinc bedplate. By using a sharp instrument instead of a pencil or stylus scratched lines will appear, which may be made permanent by the use of copper sulphate, sulphuric acid, or muriatic acid applied with a steel pen. After the acid has dried, a few drops of oil rubbed over the plate will bring out the lines in bold relief.

The pen.

Oil the pen daily, removing the surplus oil by rolling across a blotter. To keep the pen free from gum and paraffin, immerse the wheel in benzine, alcohol, or ammonia. As no two writers hold the pen at the same angle, each map maker should have a pen for his sole use.

The stencil.

Stretch the stencil tightly over the frame, using clamps if necessary. If clamps are not available, holes may be made through the frame and six or eight 1-inch stove bolts used to hold the stencil tight. If the stencil bags from raising and lowering the frame, a slit in it will allow the air to pass out. The slit can be closed by a strip of the same stencil glued on when ready for the pad. After placing the stencil on the pad, paste two strips of paper at right angles along the lines of registration to aid in printing. A little kerosene oil applied to the stencil with waste or a camel's-hair brush and quickly blotted off will improve imperfect perforations.

Typo-stencil.

Where the typewriter is used the typo-stencil is set in the map stencil by cutting out a piece of the autographic stencil paper and fastening the latter on by the use of a heated iron before putting the stencil on the milliograph pad.

The data.

Incorrect entries may be obliterated by slightly heating a smooth piece of metal and applying it to the stencil. Some operators rub out the erroneous entry with the top of the pen or the glass stopper of an ink bottle. The data to be entered on the map should be determined by the local needs of each station. The isobars will generally show the distribution of pressure sufficiently well to warrant the omission of the barometer readings at stations. When the "Dey" apparatus is in use, the shading is of itself sufficient to represent temperature changes. The figures may therefore be omitted from the map.

Precautions.

When writing on the stencil a blotter should be used to prevent the heat from the hand and arm from stopping up the perforations or melting the stencil paper. In entering the data use a firm, steady pressure on the pen. Small figures, carefully and uniformly made, close to the station, are to be preferred to large, scattered figures. Barometer and temperature figures should be entered in pencil on a separate map and isobars and isotherms drawn thereon with red and blue pencils. This map should then be placed under the stencil and the isobars drawn. A blotter should then be placed under the map and the wheel used to make the isotherms. If the isobars are too

dark and heavy by this process, they may be traced on the stencil directly against the zinc. In drawing lines, the pen should be held firmly in the right hand and the left hand used to guide it.

High or low.

The words "high" and "low" should be in good-sized plainly made letters, and should be confined within the inner lines of the areas thus marked. The synopsis should show the striking features of the map, the movement of the areas of high and low pressures, and such other information as may be of general interest. Special attention should be called to wet or dry spells, or protracted periods of heat and cold.

The milliograph pad and the ink.

The first application of ink to a new pad will require nearly half a can to thoroughly saturate it; after that a tablespoonful should be sufficient for an issue of about one hundred maps The ink should be heated in winter to a temperature of about 75°, and the stone of the pad warmed by placing it on a steam radiator or over a spirit lamp, care being taken not to overheat the stone, thus drying up the ink already on the pad. The ink should be thoroughly and evenly distributed and well rubbed into the felt pad, and the rubbing should be in all directions. The muslin cover should then be placed over the pad and the distribution and rolling continued until the ink is thoroughly well worked through the cambric. The back of an old unfolded map should then be placed on the muslin and the dry roller run across it. If the map when taken off shows a uniform blackness and has a velvety appearance, the muslin is in proper condition for use; if spotted, it shows insufficient ink or uneven distribution. This process should be repeated until the map thus made shows black all over. The purpose of placing the map on the muslin before putting on the stencil is to take up the superfluous ink and prevent the stencil from slipping and creasing when the regular issue is run off.

Roller to be used.

The dry roller should be kept clean and smooth and hung up after using to prevent flattening. Any ink should be at once removed from this roller to prevent its hardening and cracking. The stencil should be left on the milliograph until about an hour before the issue of the next day, in order to prevent the ink from drying. The pad should be put in readiness for the current issue before the reports are received, so as not to lose any time. Once a month the pad should be cleaned by softening the hardened ink around the sides with coal oil and rubbing with the ink roller; then take old maps or newspapers and lay them on the pad, one at a time, running the roller across until all the ink possible is taken up. If necessary, then take off the felt and wash with warm water and soap. This may require the use of twenty-five or more maps or newspapers. The muslin should be cleaned in the same way, except that the frame must be reversed, laid on a table with paper under it, and the map or the paper put in the inside of the frame. Where the ink is still hard, soften with benzine, ammonia, or alcohol. The muslin should be in such condition that when held to the light, without a stencil on, light can be seen through the meshes.

Ink.

The ink can should remain closed when not in use, as otherwise a scum forms over the oil. Stir the ink well before using, as the oil rises to the top of the can and makes the ink too thin on top and too thick at the bottom of the can.

How thinned.

The ink may be thinned with kerosene or olive oil.

Registration.

In running off maps great care should be taken to see that the edge of the map is at the registration mark on the stencil. One corner of the map should be bent up, this corner quickly caught, and the map raised as fast as the roller passes along, so that when the roller has

passed off of the map the latter will also have left the pad. This will prevent the lines and figures from having a ragged or dragged appearance. The roller should be firmly held and a steady, even pressure used, being careful not to let the roller slide or turn and run off at one corner when leaving the maps, as this will crease the stencil.

How to print. The rolling should be one way only, from left to right or from right to left, not first one way and then another.

Some operators obtain their best copies by using more ink and less pressure; others by using but little ink and greater pressure.

Removal of surplus ink. As maps are printed they should be laid one on top of another, and after twenty-five or more copies have accumulated, a blotter should be placed on the top map and the dry roller run over them, so that the surplus ink on each map may offset on the back of the map above it.

Folding. Probably the best and quickest way to fold maps is to take a number and crease them on a line east of the eighty-fifth parallel and west of the one hundred and fifth parallel. Fold the ends in, then double through the center and double again.

Mailing. A mailing list should be made up for each train to prevent loss of time in case of reports being received late. This can easily be done by classifying the patrons of the map and printing, half an inch apart, the names and addresses of those reached by each train, on a piece of stencil paper, and milliographing a supply. These addresses can be pasted on the wrapper and a supply made up to last a week or two much easier and quicker than the list could be written daily.

STATE WEATHER SERVICE.

Duties

Officials in charge of State weather service centers will, in addition to their regular duties, have charge of the preparation of State weather service publications and the weather-crop telegrams sent to the central office. They will also be held responsible for all property in the hands of voluntary observers and other persons in their respective States cooperating with the Bureau in any capacity.

Establishment of substation.

In the establishment of substations both of observation and those for the display of weather signals, etc., care should be exercised to secure the services of intelligent and trustworthy persons who will faithfully discharge the duties to be undertaken. Care should be taken to locate observing substations in communities from which the observations will prove of the greatest possible value to the National and State services.

Collection of data.

In the collection of weather-crop reports, effort should be made to secure from every county in the State two or more reliable and intelligent persons who will render accurate and impartial reports as to the weather and crop conditions during the season of planting, cultivating, and harvesting.

Weather-crop bulletin.

The State weather-crop bulletin should contain an accurate summary of the weekly reports from weather-crop correspondents. Each of the staple crops should receive special mention; and as many of the correspondents' reports should be published as may be practicable.

Monthly weather review.

The monthly weather reviews of the State services should be made as complete and as interesting as the available material will permit, and when practicable temperature and precipitation charts should be made a feature of the report. Tables giving daily means and extremes of temperature and rainfall are of the utmost importance, and should if possible form a part of every report.

Annual report.

As soon as practicable after the close of the fiscal year a report covering the operations of the State weather service during the twelve months ending June 30 will be prepared and forwarded to the central office, and at the close of each crop season a review of the weather and crop conditions of the season will also be prepared and forwarded. The latter report should include a statement showing dates upon which farm work was begun; the condition of the soil as to moisture, etc., at the beginning of the season; periods of drought, wet weather, or normal conditions; cool or warm spells; hot winds, etc., and the effect of these various phenomena upon the different crops.

COTTON AND SUGAR AND RICE SERVICE.

Organization.

The disasters of drought, frost, flood, violent windstorms, and sudden and decided changes in temperature, to which the cotton plant is exposed, have created a demand for timely information as to the meteorological conditions and the state of the plant as affected thereby during the growing season. Provisions have been made, therefore, for daily telegraphic reports of maximum and minimum temperatures, the amount of rainfall, and of the occurrence of frost and severe storms from the middle of April to November each year from certain stations technically known as cotton-region stations.

In the State of Louisiana a number of stations are also maintained for the benefit of sugar and rice interests. The cotton, sugar, and rice growing regions have been divided into districts and arranged to prevent the overlapping of territory which would produce errors in the preparation of the temperature and rainfall reports. Each district has a center for the concentration of reports from the several special stations, and the name of this center is used to designate the district.

Selection of observers.

In the selection of cotton, sugar, and rice region observers special effort should be made by the official in charge of the district center to secure the services of persons interested in meteorological work, who will be willing to continue the observations, without compensation, during the period from December 1 to April 15, when regular cotton-region observations are not taken.

Relief of observers.

When an observer resigns or from other cause ceases to perform his duties, the fact will be immediately reported to the central office, giving the date upon which the retiring observer's services terminate and the name of his successor, with date upon which the latter's services began. When such changes occur, special care will be devoted to instructing the new observer in all the duties pertaining to his station.

Instructions to observers.

Full instructions for the guidance of the observer in charge of cotton-region stations will be found in the pamphlet Instructions to Cotton-Region Observers.

Exposure of instruments.

The best possible exposure of the instruments should be obtained, and after securing such an exposure no change should be made unless authorized by the official in charge of the district center.

Heavy rainfalls to be investigated.

Exceptionally heavy rainfalls or unusual temperatures reported at times when the official in charge of the center has cause to question the accuracy of the report should be made the subject of careful inquiry, and if upon investigation the report is found erroneous the necessary corrections should be made in the station records, the fact reported to the central office, and the observer cautioned against a repetition of errors of similar character.

Duties of observers.

The duties of observers at these stations consist in taking and recording observations at 8 a. m., seventy-fifth meridian (Eastern time), of (1) the maximum temperature; (2) the minimum temperature; (3) the amount of rainfall during the past twenty-four hours; (4) the state of the weather; (5) the occurrence of light or killing frosts or severe storms, tornadoes, or violent thunderstorms.

Data tabulated.

Observers in charge of centers having collected all the reports from the stations in their respective districts so far as possible, will make up the mean maximum temperature, mean minimum temperature, and average rainfall for the district. The means of the maxima and minima temperatures must be found separately.

How to obtain the average.

To calculate the average rainfall of a district divide the sum of the amounts of the rainfall reported from all the stations by the number of stations reporting; the quotient will be the average rainfall for the district.

Example.—Savannah district: Stations reporting November 1 were Savannah, Americus, Bainbridge, Gainesville, Albany, Millen, Cordele, Way Cross, Quitman, Thomasville, Southport, Fort Gaines, Eastman, and Allapaha; a total of 14. The amount of rainfall, respectively, was: 0.00, 0.00, 1.06, 0.00, 2.50, 0.00, 0.00, 1.00, 2.52, 0.00, 1.05, 1.25, 1.06, and 1.78; a total of 12.22 inches, which, divided by the number of stations reporting (14), gives as the average rainfall of the district 0.87of an inch.

Mean temperature.

To calculate mean temperatures, find separately the sum of the maxima and minima temperatures, divide each by the number of stations reporting, the quotient will be the means of each for the district.

Telegraphic means.

The telegraphic means from districts will be made up from the reports of the special stations received by the observer. The words "two," "three," "four," etc., will be added to the cipher used in sending these reports over circuits to indicate the number of stations, including his own, used in making up the means. If no reports are received from special stations, the central station will send its own report, and add the word "one," to show that no reports were received.

Reports over circuits.

To illustrate the method of sending reports over telegraphic circuits, take Savannah as a district center. Savannah calculates the mean of the maxima and minima temperatures, the average of the rainfall for the district, and sends this report written on Form 1061:

Savannah; fourteen; raiment; thirteen; Thomasville; killing; thirty-six.

Translation.

This translated reads: Fourteen stations have reported to Savannah; the mean of their maximum temperatures is 72°; the mean of their minimum temperatures is 54°; and the average rainfall is 0.13 of an inch; killing frost reported from Thomasville, with a minimum temperature of 36°.

Frost.

When the first killing frost is reported from any special station the fact will be reported by telegraph, together with the minimum temperature, with the regular cotton-region report, placing name of station, etc., immediately after the means and averages for the district, as shown by the preceding paragraph.

Heavy rainfalls to be reported.

Observers in charge of centers will note all special cotton-region stations reporting 1.50 inches or more of rainfall, and add the name of station and amount of precipitation in tenths to the regular 8 p. m. signals; hundredths will be reported to the nearest tenth.

Weekly means.

During the period when the National Weather Crop Bulletin is issued officials in charge of district centers will prepare and file for transmission to the central office, on Monday evening, a special telegram giving the weekly mean temperature and total weekly precipitation for the week ending with the a. m. observation on Monday for all cotton-region stations in their respective districts.

For example:

"To "*Weather, Washington:*

"Columbus, hannah; Gainesville, common; Greenville, unmoved; Griffin, annual; Macon, bulk; Newnan, dunny; Spartanburg, tomina; Toccoa, five annual; West Point, eleven bunyan."

The above would be sent to convey the following data:

Station.	Temperature.	Rainfall.	Station.	Temperature.	Rainfall.
Columbus	61.4	Trace.	Newnan	60.9	1.00
Gainesville	58.7	Missing.	Spartanburg	57.0	4.90
Greenville	57.5	0.00	Toccoa	59.1	5.10
Griffin	59.3	0.10	West Point	61.0	11.50
Macon	Missing.	0.50			

Rendition of forms, reports, etc.

The cotton region observers receive their instructions from and render all reports and bills to the officials in charge of their respective centers. Officials in charge of cotton-region centers will prepare for the resumption of observations at the stations in their respective districts in advance of the opening of the season, and will see that all arrangements are complete and that no delay occurs in beginning observations at any station in their districts.

INSPECTION OF PROPERTY.

AT BUREAU.

Inspection at Bureau.

Property purchased and delivered to the central office for the use of the Bureau proper, or for issue to station, will be referred for inspection to the division or room concerned or official for whom purchased.

AT STATION.

Inspection at station.

Property purchased at station or that purchased and issued to station without passing through the Bureau shall be inspected by the official responsible for the property at such station, the necessary coupons being sent him from the central office for signature.

MISUSE OF PROPERTY.

Misuse of property.

Public property must not be perverted to private use.

Embezzled, lost, or damaged through neglect.

If any article of public property be embezzled, or by neglect lost or damaged, by any paid employee of the Weather Bureau, the value or damage shall be charged to him and set against any pay or money due him.

GROUPING OF PROPERTY.

Grouping.

Weather Bureau property is divided into three general classes or groups, viz:

Group X, that of an expendable character, such as stationery and forms.

Group Y, that partaking of the character of expendable property, such as flags and wire.

Group Z, that of an unexpendable character, such as instruments and furniture.

The following lists show to what groups the various articles of property belong. Additions may be made from time to time to these lists, as articles not now enumerated may be purchased and issued:

Group X, expendable.

Acids (all kinds).
Alcohol.
Alum.
Ammonia, aqua and liquid anhydrous.
Angle irons.
Arms and cups for anemometer.
Axle grease.
Bands, rubber.
Barrels.
Baskets for hand grenades.
Batting, cotton.
Beakers.
Belting, leather.
Benzine.
Blades, hack saw.
Blanks for forms.
Boards, hygrometer.
Bolts, assorted.
Books, blank.
Books, directories.
Books, letter copying.
Books, manifold.
Books, map, A and B.
Books, scrap.
Books, scratch.
Boxes, coal or wood.
Boxes, packing.

Group X, expendable.

Boxes, pasteboard.
Boxes, wind direction contact.
Bottles.
Brackets.
Brass.
Brooms.
Brushes (all kinds).
Burners, lamp.
Bulbs, assorted.
Candles.
Carbons, battery.
Cardboard.
Cases, mailing.
Castings.
Charcoal.
Chimneys, lamp.
Chemicals.
Cisterns, barometer.
Cloth, tracing.
Coal.
Composition.
Compound Chattertons.
Connectors, single and double.
Contacts, wind direction.
Copper.
Copper, sulphate.
Copper, tubing.
Coppers, battery.
Cord.
Corks.
Cotton.
Couplings.
Covers, bell.
Cross arms, telegraph and anemometer.
Cups, hygrometer.
Cups, porcelain.
Curves.
Cylinders, glass.
Cylinders, graduated.
Dials, wind direction.
Dishes, evaporating and crystallizing.
Disks, cipher.
Dusters, feather.
Electrotypes.
Envelopes.
Erasers, rubber.
Excelsior.
Eyelets.
Eyes, screw.
Fasteners, paper.
Felt.
Files, paper.
Files, Shipman's.
Fixtures, lamp.
Flannel.
Flasks.
Fluids, obliterating.
Fluids, soldering.
Forms.
Foot rests, iron.
Funnels, glass.
Furniture, printing.
Glass.
Glasses, bell.
Glasses, graduated.
Glasses, test
Glue.
Goblets and tumblers.
Grates.
Grenades, hand.
Gum arabic.
Gum, shellac.
Guy rods.
Hasps.
Hangers, battery.
Hay.
Hinges.
Hooks.
Horses, wooden trestles.
Hydrometers.
Ice.
Ink (all kinds).
Insulators.
Ivory black, pigment.
Jugs.
Keys.
Keys, blank.
Keys for quoins.
Kid skins.
Knobs, door.
Lacing, belt.
Lawn.
Lead, white.
Leads.
Leather, scraper.
Locks (all kinds).
Logotypes, rubber.
Lights, Coston.
Lumber.
Lye.
Map backs, wooden.
Maps, paper.
Matches.
Mercury.
Mica.
Millinette.
Mops.
Mucilage.
Muslin.
Nails.

Group X, expendable.

Needles.
Oil.
Oil boards.
Pads, desk.
Pads, ink.
Paint.
Paper (all kinds).
Paraffin.
Paste.
Pencils.
Penholders.
Pens.
Pens for registering instruments.
Pens, ruling, Gisburn's.
Pins.
Pipe, iron.
Pipettes.
Plates, base.
Plates, stereotype.
Platforms.
Plugs, insulator.
Plugs, safety.
Polish, stove.
Posts, binding.
Powder, etching and insect.
Pumice stone.
Quoins.
Rags.
Railings.
Reagents.
Reducers.
Reflectors.
Retorts.
Ribbons, typewriter.
Rings, screw.
Rope.
Rollers, antifriction.
Rubber.
Rule, brass.
Rule, printing.
Sal ammoniac.
Salt.
Sand.
Sash cord.
Sawdust.
Screws.
Sealing wax.
Shakers.
Sheets, copying, rubber.
Shelving.
Soap.
Solder.
Spikes.
Sponges.
Springs, steel or brass.
Stamps, office, rubber hand.
Stamps, postage.
Staples.
Steel.
Sticks, measuring.
Stones, lithographic.
Straps.
Supports, wooden.
Syphons, glass.
Tacks.
Tallow.
Tape.
Taps.
Thread.
Tin.
Tickets, car.
Towels.
Tubes, barometer.
Tubes, paper, mailing.
Tubes, testing.
Tubing, brass and rubber.
Turpentine.
Twine.
Type, rubber.
Valves.
Varnish.
Vessels, glass, earthenware, and stone.
Vise springs.
Waste, cotton.
Wax.
Weather symbols.
Whips.
Wicks.
Wicking.
Wire for stitching machine.
Wood.
Wrappers.
Zinc.
Zincs.

Also all articles of a strictly expendable character, not otherwise specified, and all material or parts which may be hereafter purchased for the construction or repair of any instrument or machine.

Employees will, however, be expected to preserve surplus and impure mercury, extra and defective electrical contacts, cross-arms, foot rests, and such parts of apparatus as from their nature may be useful in repairs that can be made at the central office. Generally, special

instructions will be given for the disposition of such articles at the time they are replaced or become surplus at station.

Group Y, partaking of the nature of expendable property.

Batteries, Cassner's.
Batteries, dipping.
Batteries, water.
Bits, augur.
Binders, Conant.
Blotters, hand.
Boards, bulletin.
Boxes, ice.
Boards, cautionary signal.
Boards, letter clip.
Bags, rubber.
Boots.
Boots, iron.
Bowls, dampening.
Bulbs, aspirating.
Bulbs, conjugate.
Cable.
Chamois skins.
Clips, office.
Clamps, iron-screw spring.
Cords, telephone.
Cover glass, holders.
Cups and saucers.
Cups, color.
Cups, sponge.
Cups, tin.
Chandeliers.
Dies, steel, figures and letters.
Demijohns.
Dippers.
Dishes, table.
Drill bits.
Files, machinists'.
Flags (all kinds).
Forceps.
Frames, map and bulletin.
Fixtures, gas.
Glasses, eye.
Halyards.
Handles (all kinds).
Hones.
Hose, rubber and canvas.
Inkstands.
Knives, assorted.
Maps, weather, large.
Mortars, pestles.
Nipples.
Pokers.
Poles, telegraph.
Palettes.
Racks, test tube.
Racks, pen.
Rollers, dampening.
Radiators.
Rollers, towel.
Rollers, duplicating, without frames.
Rulers.
Scrapers.
Signs, office.
Sieves.
Slabs, ink.
Stamps, self-inking.
Stencils.
Stovepipe, joints of.
Vessels, tin.
Whetstones.
Wires (all kinds)
Tweezers.
Thermostats.
Type, metal.
Type, metal and rubber-faced.

GROUP Z, UNEXPENDABLE.

5. Comprises all articles of an unexpendable nature, and not included in the two preceding groups.

6. In addition the following articles will hereafter be considered as of Group Z:

Arbors, lathe-rest.
Books, Instructions for Weather Bureau Observers.
Books, International Code.
Burners, Bunsen.
Buttons, push.
Backs, lathe-rest.
Benches, lathe.
Chucks, lathe.
Cans, copper
Dogs, lathe.
Frames for duplicating rollers.
Funnels, copper and brass.
Matrices.
Nozzles, hose.
Rings with lathe.
Rules, composing.
Pens, ruling.
Pointers, pencil, machine.
Supports, sunshine recorder, brass.

Shelters, instrument.	Traps, mouse and rat.
Styli.	Triangles.
Slides, lathe-rest.	Weights, paper.
Testers, thermometer.	

ACCOUNTABILITY, CARE, AND PRESERVATION OF PROPERTY.

AT BUREAU.

Official responsible.

1. The assistant stationery and property clerk, or such other official as may hereafter be designated, shall be responsible for all Weather Bureau property located at Washington, D. C., and shall give a good and sufficient bond for the proper performance of his duties.

Semiannual returns from divisions, etc.

2. The several divisions, rooms, and officials at the Bureau will make a semiannual return, on the 31st day of December and 30th day of June, to the assistant stationery and property clerk of all Y and Z property in their possession.

Semiannual return.

3. The assistant stationery and property clerk will make to the Chief of Bureau, and he to the Secretary of Agriculture, a semiannual return, on the 31st day of December and 30th day of June, of all Y and Z property at Bureau for which he may be responsible. Such return will include, first, the property actually on hand or for which memorandum receipts are held; second, abstract of property purchased at Bureau; third, abstract of property purchased at station; fourth, abstract of property issued to station; fifth, abstract of property received from station, and sixth, miscellaneous vouchers, such as inventory of property sold, etc., if any.

AT STATION.

Employee responsible.

4. Any official or other employee at Weather Bureau stations who may be intrusted with public property or supplies is directly responsible to the Chief of Bureau for the same, and will be held strictly accountable for all such property or supplies for which he may have given his receipt. (See act of Congress approved October 12, 1888.)

Returns, when rendered.

5. All officials or employees at station responsible for property will render semiannual returns within twenty days after the 31st day of December and the 30th day of June of all Y and Z property for which they are responsible. Similar returns will be made when by reason of transfer, change of station, leaving the service, it becomes necessary to close their accountability.

An exact account of all such property issued will be kept in the office of the Chief of Bureau, and until every return due has been rendered, examined, and closed, persons accountable for property will not be relieved from responsibility therefor; and until the disposition of the property has been satisfactorily accounted for, such persons will be held responsible for the money value of the property not satisfactorily accounted for.

Returns to include.

6. Such returns will show, first, property on hand from last return; second, property received during the half year, together with that invoiced during the half year and received within the twenty-day limit; third, property issued during the half year; fourth, property otherwise disposed of during the half year; fifth, property at substations.

Property received without invoice.

7. Any Y or Z property received will be taken up on the returns, whether invoice is received or not, and the fact of such nonreceipt of invoice reported to the central office by letter. A footnote will be

made on return, stating that such property was taken up without invoice.

Vouchers to accompany returns.

8. The authority for all property taken up (except that invoiced from the central office), and for all property dropped or otherwise disposed of (except that receipted for by the central office) during any six months, will accompany the return for that period as a voucher for such action. Each voucher will be numbered or lettered and proper reference made to each voucher by its number or letter on the returns. Copies of such authority may be made and filed with retained return, if desired.

Actual count to be made.

9. An actual count of property on hand will be made at the time of rendering a return, and any excess found will be taken up, and a footnote stating the circumstance made on the return. Any deficiency will be reported by letter to the central office.

Return not to be held back.

10. If any property is not received within a reasonable time after shipment, the fact will be reported to the central office, but the semiannual property return will not be held back awaiting the receipt of such property beyond the twenty-day limit.

Property, when and how taken up.

11. Property received from this office or purchased at station on proper authority must be taken up on the semiannual return as received during the six months for which invoices are sent, and the aggregate of the property received during the half year, together with that on hand to be accounted for from last return, must be brought down in the line opposite the word "Total." This gives the debit side of the return.

12. Property disposed of by proper authority or returned to this office during the half year will be noted in the proper column, and the aggregate brought down and deducted from the total above mentioned. The remainder will be the total on hand to be accounted for, and will be *carefully and exactly* taken up on the succeeding returns as "On hand from last report."

Headings not to be changed.

13. In all cases in making up returns the headings will never be altered or changed, but when articles other than those enumerated in the printed headings are at station they will be inserted in the blank lines for that purpose on the return.

Examination of returns to be final.

14. The examination at the central office of the returns of Weather Bureau property of any employee having such property in possession, under proper authority, will be considered final and conclusive, and such returns, after adjustment of any errors, will be filed in that office.

Errors in returns.

15. Errors found in the examination of any return will be charged against the record of the official responsible for the property.

Property at substations.

16. The official in charge of a station is responsible for all Y and Z property at substations. He will obtain and keep on file at his office memorandum receipts for such property issued, and will obtain a semiannual return, if necessary, of property held and received at such substations. Any failure of a subemployee to furnish such return when required will be reported to the central office.

Action on death or disappearance of official in charge.

17. Upon the death or disappearance of an official responsible for property the first assistant, if any, or such person as may be designated by the Chief of Bureau, will immediately take charge and report the fact briefly by telegraph to the central office. After taking charge an inventory in duplicate of all property and supplies (X, Y, and Z property) will be taken and a return prepared in duplicate, in which such inventory will be used as a voucher for taking up the Y and Z property, one copy of the inventory and return to be forwarded to

the central office for examination and the other copy of the inventory and return to be retained by the official designated as a basis for future returns.

Final payment, when made.

18. When an official or employee responsible for property leaves the service of the Weather Bureau, final payment will not be made to such official or employee or a release made of any bond given until full and satisfactory evidence has been furnished that the property with which he may have been intrusted has been duly accounted for.

Repair of property.

19. Whenever it becomes necessary to repair any property at station or substation, except thermometers and delicate instruments, a report, fully setting forth the necessity, will be made to the central office, giving the exact cost, if possible, if the amount does not exceed $10; otherwise the estimated cost. Upon the receipt of such report the necessary action will be taken by the central office and the official notified.

Action upon discontinuance of station.

20. Upon the receipt of notice of the discontinuance of a station the official in charge, or other person designated by the Chief of Bureau, will immediately prepare and submit to the central office a list of all property on hand, stating what property in his judgment is worth cost of transportation, what property is not worth cost of transportation but could probably be sold at auction, and what property is not worth cost of transportation and which could not be sold. The Chief of Bureau will then issue instructions for the shipment, sale, destruction, or abandonment of the property.

After the instructions have been complied with a final return will be made to the central office, showing the disposition made of each article and accompanied by a certificate showing what articles have been destroyed or abandoned.

TRANSPORTATION OF PROPERTY.

FROM BUREAU TO STATION.

By mail.

1. All property will be shipped by mail when practicable and when the weight thereof (except instruments) does not exceed 40 pounds. Packages of value exceeding $1 will be registered in the usual manner and delicate instruments sent by Railway Mail Service.

By Quartermaster, and how marked.

2. Packages exceeding 40 pounds in weight will be shipped through the Quartermaster's Department after such transportation has been duly requested on the usual form giving the necessary information. Each package will be marked as indicated by the dray ticket, and in addition thereto with the words "Property of the United States," and receipted for by the drayman upon its delivery to him.

By express.

3. Property will be sent by express only when conditions will not permit of its being sent by mail or Quartermaster. All packages will be marked, in addition to the address, with the words "Property of the United States."

The accounts division will be notified of all such shipments, giving estimate of cost, in order that proper charge may be made.

FROM STATION TO BUREAU—FROM STATION TO STATION—FROM STATION TO SUBSTATION.

Shipment of property from station.

4. Whenever property is ordered shipped from station to central office, from station to station, or from station to substation, the method of shipment will be indicated in such order, and the following instructions carefully complied with.

By mail, general instructions.

5. All shipments will be made by mail if practicable, delicate instruments, etc., by Railway Mail Service, sending frank or Railway Mail Service letter, if necessary, for shipment from substations. Packages containing instruments will be marked, in addition to the address, with the name of the station issuing, the contents, and the serial number of such instruments.

Shipments by mail.

The employees of this Bureau are cautioned to take special pains in the packing and shipment of all instruments, apparatus, etc., by mail, and to always bear in mind that the Weather Bureau has received special privileges in this connection through the courtesy of the officials of the Post-Office Department, and packages must be put up with due regard to convenience in handling and provided with rope or cord handles whenever these are necessary. Except under special authority from this office, the weight of any package forwarded through the mails, whether by ordinary, registered, or railway mail, must not exceed 40 pounds.

Ordinary mail.

6. The ordinary mail will be used in all cases of forwarding printed matter, parts of unserviceable instruments or apparatus, etc., of no particular value and specified as of Group X.

Registered mail.

7. The shipment of supplies, instruments, or apparatus of any kind by registered mail will always be under specific instructions from this office, in which case the letter of instructions will be accompanied by the necessary postage stamps and official franked envelope.

Railway Mail Service forms.

8. By special arrangement with the Post-Office Department the Weather Bureau has prepared special forms (No. 4014) and envelopes for the shipment of all instruments, apparatus, and supplies of value from station to station, station to substation, or station to the central office. These forms (No. 4014) are sent in quantities to the office of the General Superintendent of the Railway Mail Service, where they are signed and returned to this office for distribution to points from which they will be used.

Headings of Railway Mail Service forms not to be changed.

9. A separate form (No. 4014), with envelope, properly filled out, must be transmitted with each package sent by railway mail. In filling out the form (No. 4014) it should be borne in mind that the same is practically issued by the General Superintendent of the Railway Mail Service from Washington, D. C., and this heading must not be altered to conform to place at which used.

Disposition of Railway Mail Service forms.

10. Form No. 4014 (and envelope) will always accompany the package or box to which it belongs; it is signed by all railway-mail officials handling the same and the person to whom the package or box is consigned. The form is then forwarded by the postmaster (or proper post-office clerk) to the office of the General Superintendent of the Railway Mail Service, where, after proper note has been made, it is forwarded to the central office of the Weather Bureau. Here the forms are examined as to whether instruments or supplies have reached destination, after which they are transmitted to the official who issued the form as his receipt for same and for file. Exception is made in the cases of Forms 4014, used by voluntary and similar observers. These will invariably be returned to the *State* or *section center* for filing.

Receipts not required.

11. This Bureau has no authority by law to require postmasters to give receipts for any package or article forwarded by Railway Mail Service, but postmasters usually do not object to signing a memorandum receipt for such shipments, provided the same is prepared for them in some convenient form, as, for example, in an ordinary telegram receipt book.

12. Should postal officials at anytime refuse to receive any package or article properly prepared for shipment and accompanied by a copy of Form No. 4014 and envelope correctly filled out and addressed, their attention will be politely invited to the instructions on the face of the form: that the shipment must not be treated as "ordinary" mail matter, but that it must be handled in accordance with the instructions on the form, which it will be noticed are signed by the General Superintendent of the Railway Mail Service, and are at once the authority for the receipt of the package and their instructions as to its disposition. Refusal of post-office officials to receive railway mail.

13. When a shipment is ordered through the Quartermaster the goods are to be packed without expense, if possible, and marked, in addition to the address (and such marks as directed by the Quartermaster), with name of station issuing, weight, nature of contents, and the words "Property of the United States." By Quartermaster, how marked, etc.

14. No property will be shipped until after the official has been communicated with by an officer or agent of the Quartermaster's Department, and all information called for by such officer or agent necessary to accomplish the shipment will be promptly and fully furnished. Communication with Quartermaster's Department.

15. The original bill of lading will be completed and returned to the officer issuing it; the duplicate completed and returned to the carrier or freight agent. A careful record of all bills of lading will be kept on file at station, making note especially of their number, date, place at which issued, name of issuing officer, and character of the property. Bills of lading.

16. Property will be shipped by express only when so ordered by the central office or there is an emergency that fully justifies such action. By express.

Full reports of all such shipments will be made to the central office on day of shipment, the official procuring and forwarding original (so marked) express receipt with such report, unless it has been necessary to prepay charges, when the original receipt will be forwarded with his account for reimbursement. A duplicate receipt should be retained by the official for his own protection.

DRAYAGE.

17. Whenever shipments by freight are delivered by carriers at their depots or wharves only officials will hire the necessary drayage from such places to office and procure and forward to the central office receipted bills and vouchers for such drayage, indorsing upon the bill the number and date of the bill of lading, the name of the officer who issued it, and the contents of the packages. In the case of drayage on shipments by mail the bill for same will be indorsed with the weight and contents of each package. At station.

TRANSFER OF PROPERTY.

Invoicing and Receipting.

AT BUREAU.

1. No property or supplies will be issued to any division or room except upon a request duly signed by the official in charge of such division or room. All property issued (except that belonging to Group X) will be duly invoiced and receipted for and taken up on the semi-annual returns of the several divisions or rooms. At Bureau.

FROM BUREAU TO STATION.

From Bureau to station, X property.

2. Articles belonging to Group X will be invoiced and receipted for on the proper form; they will, however, be considered as expended when issued and thus receipted for, and will not be taken up or accounted for on the semiannual return.

Groups Y and Z.

3. Articles belonging to Groups Y and Z will be invoiced and receipted for on the proper form and taken up and duly accounted for on the semiannual return.

Not to be receipted for until received.

4. Property invoiced will not be receipted for by any official until the full amount receipted for is actually received and the invoice verified.

FROM STATION TO BUREAU.

X property.

5. Any X property returned to the central office will not be invoiced nor receipted for.

Y and Z property.

6. Y and Z property will be invoiced and receipted for in the usual manner except as hereinafter stated. (See Final Disposition of Property.)

FROM STATION TO STATION.

Not to be transferred without authority.

7. Property will not be transferred from one station to another without special authority from the central office.

Invoices and receipts to be made in duplicate.

8. When property is transferred from station to station invoices and receipts will be made in duplicate. The duplicate copy of the receipt will be filed with the property return that is sent to the central office and from which the property is dropped and likewise the duplicate copy of the invoice will be filed with the property return that is sent to the central office and upon which the property is taken up.

FROM STATION TO SUBSTATION.

Memorandum receipts to be obtained.

9. A memorandum receipt will be obtained by the official issuing for all Y and Z property shipped to substations.

If the property has been requested shipped direct to substations from the central office such receipts will be called for as soon as invoice is received. (See Par. 16, page 58.)

FROM EMPLOYEE TO EMPLOYEE.

Transfer during temporary absence.

10. During a temporary absence of from three to thirty days a memorandum receipt for Y and Z property will be obtained by the official in charge from the person to whom the transfer is made. If the absence is to be for more than thirty days a formal transfer will be made in the same manner as on being relieved, except that no return or inventory will be forwarded to the central office. Upon reassuming charge such receipts or returns will be returned to the person issuing them.

Transfer on being relieved.

11. Upon being relieved from charge of a station the retiring official will turn over to his successor all property and stores for which he is responsible, taking receipts, as follows:

Inventories to be taken on X property.

12. An inventory in duplicate will be made and receipted for of X property, one copy of which will be forwarded to the central office with the final return.

Return to be made of Y and Z property.

13. Three returns of Y and Z property on the proper form will be made, one copy, designated the final return, to be forwarded to the central office, one copy to be filed at station, and one copy to be kept by the official making the transfer for his own protection.

14. These returns will be carefully verified with each other and by actual count of the property on hand or that held on memo. receipts. Returns to be verified.

15. In no case will property not actually turned over be receipted for. Only property turned over to be receipted for.

16. A careful examination will be made of the condition of the property and the result shown on the returns, and, if the circumstances warrant such action, a written report of all damage not occasioned by ordinary wear and tear will be made to the central office by the official assuming charge. Condition of property.

17. A report of any shortage will accompany the final return. Such report must be full and comprehensive and contain sufficient evidence to enable the responsibility to be placed where it belongs Shortage to be reported.

18. Memorandum receipts for property at substations will be accepted in lieu of such property. Property at substations.

19. Employees in charge of substations will, if required, furnish a return of property on hand at the time of transfer. Returns from substations.

MISCELLANEOUS INSTRUCTIONS.

1. All shipments of property will be invoiced not later than three days after shipment and receipted for as soon as received. Invoice, when made.

2. In making invoices or receipts the group to which each article belongs will be indicated thereon. Grouping to be indicated.

3. A careful comparison will be made of each invoice with the property actually received, and if found correct the receipt will be completed, compared with the invoice, and promptly returned to the consignor. Comparison to be made.

4. If the property received does not correspond with the invoice a report by letter will be made at once to the consignor, that proper action may be taken. Report on discrepancies.

5. Only property actually received will be receipted for. Receipts given.

6. Invoices will be filed by the consignee and receipts by the consignor with their retained property returns. Receipts, where filed.

7. A report by letter to the consignor will be made of any property invoiced and not received within a reasonable time, bearing in mind, however, that shipments by Quartermaster are frequently delayed en route. Property invoiced and not received.

8. Property purchased upon proper authority at stations outside of Washington, D. C., for official use at such stations will be regularly invoiced to the person purchasing upon receipt at the central office of the proper certified bill, which must accompany the account for settlement. Property purchased at station, when invoiced.

FINAL DISPOSITION OF PROPERTY.

AT BUREAU.

1. X property will be considered as expended and all responsibility therefor cease whenever such property has been consumed or worn out in the Government service. When issued to station the responsibility therefor is transferred to the official to whom the property is consigned. X property, how expended.

2. Unserviceable Y and Z property will be turned in to the official responsible therefor by the several divisions or rooms for final disposition and will be duly invoiced and receipted for. Unserviceable Y and Z property to be turned in.

3. A board of survey will be appointed by the Chief of Bureau, subject to the approval of the Secretary, to serve for the current Board of survey.

fiscal year, whose duty it will be to pass upon all property submitted to it for condemnation and make recommendation as to sale or other disposition.

Condemnation of property.

4. A list will be prepared by the official responsible of all unserviceable property on hand at such times as may be considered necessary. This list will be submitted to the chief clerk, who will direct the board of survey to take action. After the board has taken action two inventories of the property condemned will be made by the assistant stationery and property clerk, dividing the property into such lots as may be necessary for convenience of sale.

Sale of condemned property.

5. Upon the approval of the Secretary, the property will then be sold to the best advantage, after securing competition thereon, by the official responsible therefor, one inventory of the property to be given to the auctioneer and one to be retained by the official responsible. The gross proceeds of any such sale will be delivered to the assistant disbursing officer.

Voucher to semiannual return.

6. A list of property thus sold will accompany the ensuing semiannual return as a voucher for the dropping of such property.

Property to be turned in to Department.

7. Serviceable property, and that of value, not condemned and of no further use to the Bureau, may be sent to the Department for final action, being invoiced and receipted for in the usual manner.

Property lost, stolen, or burned.

8. If any property should be lost, stolen, or burned through no neglect of the official responsible therefor, a report showing fully all the circumstances of the case and the action taken, if any, will be made through the Chief of Bureau to the Secretary, and a request made for authority to drop such property from the returns. This authority, when granted, will accompany the ensuing semiannual return as a voucher for the dropping of such property.

AT STATION.

X property, how expended.

9. X property will be considered as expended, and all responsibility therefor cease whenever such property has been consumed or worn out in the Government service. When transferred to another station, or issued to a substation, the responsibility therefor is transferred to the official to whom the property is consigned.

Y property, how expended.

10. Y property, when actually and necessarily used or rendered entirely unserviceable, will be dropped from the return. A certificate (Form 2028, accounts, the headings of which indicate what is required in connection therewith) covering such property will be forwarded with the ensuing semiannual return as a voucher thereto.

Duplicating rollers.

11. When it is desired to recast duplicating rollers (Group Y) *without frames*, which have become unserviceable they will be forwarded by ordinary mail to the central office accompanied by the request for new ones and will not be invoiced or receipted for, but expended on Form 2028. New ones will, however, be invoiced and receipted for in the usual manner.

Z property not to be dropped, etc.

12. Unexpendable (Z) property will not be dropped, expended, destroyed, or otherwise disposed of without authority from the Chief of Bureau.

Unserviceable property to be held for inspector's action.

13. When unexpendable property, except as hereinafter provided, becomes unfit for service, the facts will be reported to the central office by the official responsible and the property, unless otherwise directed, submitted for action to the inspector next visiting the station.

Property destroyed by inspector.

14. Credit will be given for property condemned and destroyed by an inspector as soon as his report shall have been received and examined.

15. If any property shall have been destroyed by an inspector for which no credit is given, report of such fact must be made without delay. Property destroyed for which no credit is given.

16. The Chief of Bureau shall have authority to direct the selling at auction or the dropping of unserviceable property at station, when the value of such property does not exceed $500, upon the recommendation of an inspector, or without such recommendation when in his judgment it is to the interest of the service. (5740, accounts, 1891.) Authority to sell or drop property.

17. Should any property at station or substation be lost, stolen, or burned, a certificate will be forwarded to the central office by the official responsible, showing (1) a list of articles lost, etc.; (2) the circumstances of the loss; (3) action, if any, taken to recover the property; (4) whether such loss occurred through any fault or neglect of employee. Upon the receipt of the certificate it will be examined, and if found satisfactory authority will be isssued for the dropping of such property. If not found satisfactory, necessary action will be taken by the central office to recover the value of the property. Lost, stolen, or burned property at station.

18. A similar certificate will be forwarded in the case of property at substations rendered totally unserviceable or worthless, where it would be impracticable for an inspector to pass upon it and where it is not considered worth the cost of transportation to the section center or to the central office. Worthless property at substations.

19. Should repairs be needed to a thermometer, the facts will be reported at once to the central office for action. Repairs to thermometers.

20. Should a thermometer become broken or otherwise rendered totally unserviceable, the back and parts will be securely wrapped in strong paper and sent by ordinary mail to the central office. Broken thermometers.

21. The package will be marked with the name of the station, the kind of thermometer (maximum, minimum, or exposed), and the serial number of the instrument, and with the words "For Supply Division." Package, how marked.

22. The package will contain a letter setting forth and explaining the circumstances under which the thermometer was broken, stating the kind (maximum, minimum, or exposed) and the serial number of the instrument, together with a request that it be replaced, if another is desired. Contents of package.

If the explanation be found satisfactory a credit slip will be issued authorizing the dropping of the thermometer from the return of the official responsible.

If the explanation be found not satisfactory, or if the number of the instruments broken by any one person becomes unreasonably great (an evidence in itself that due care has not been exercised), or if the instrument be returned without an explanation, such action will be taken as may be necessary to hold the employee pecuniarily responsible for the value thereof.

23. Broken thermometers will not be invoiced when returned to the central office. Not to be invoiced.

When any instrument other than a thermometer becomes broken or unserviceable a full report will be made at once to the central office that action may be taken as to its disposition. Other broken or unserviceable instruments.

VIII.—REQUISITIONS FOR SUPPLIES.

1. Requisitions for forms, except Map Form D, will be made on the proper form (Form 4020) annually, between the 15th and 30th days of June of each year, and the envelope marked in lower left-hand corner with the words "Forms for Publications." Requisitions for forms.

For other supplies.

2. Requisitions for other supplies, such as stationery, envelopes, battery material, etc., *but not flags*, will be made semiannually on the proper form (Form 2046) between the 15th and 30th days of June and the 15th and 31st days of December of each year, and marked as above, "Forms for Supplies."

This form will be carefully made out, especial care being taken to show the amount on hand and that used monthly, and will include the deficiency in supplies, if any, for the ensuing six months and the complete supply for another six months, in order that at least a half-year's supply may always be on hand.

Inks, mucilage, etc.

3. Where inks, mucilage, and other articles which will not permit of shipment during cold weather are not included in annual lease, or are not authorized to be purchased at station under Circular No. 1, the request made out during June will include a supply for the entire year.

Articles not to be asked for.

4. Articles included in lease and authorized to be purchased at station will not be requested on semiannual requisitions.

Flags, how requested.

5. Flags will be requested only as needed by special requisition.

Special requisitions.

6. Special requisitions will not be made, except in cases of absolute necessity, which necessity will be fully explained thereon, and should a previous requisition have been made for the same article, such previous requisition will be referred to by date, etc.

For instruments or parts.

7. Requisition for instruments or parts will be made by ordinary letter whenever occasion arises, explaining fully the necessity therefor, and, especially in cases of request for parts of instruments, specifying in particular the precise part required, as well as the nature of the defects in the instrument to which it is proposed to apply the part. In all such requests for parts the official number of the instrument to be repaired should be given. Simple sketches or drawings will be resorted to in cases of parts difficult to describe and in regard to the identity of which doubt is likely to arise at the central office.

Proper forms to be used.

8. Requisitions for forms and those for stationery, etc., will invariably be made separately, each on its proper form.

Supplies for substations.

9. Officials in charge of substations will include in their semiannual requisitions the necessary forms and supplies for such stations.

Equipment of new substations.

10. Upon receiving notice of the establishment of any substation, the official in charge of the center will equip such station as far as possible from the supplies on hand, and make a special requisition on the central office for any that may be lacking.

Letters of transmittal.

11. No letter of transmittal will be sent with the semiannual requisitions. Should any explanation be deemed necessary, a footnote will be made on the requisition.

For further and detailed instruction relative to property, see *forms* pertaining thereto.

ACCOUNTS.

Regulations to be followed.

Employees of the Weather Bureau in making purchases incurring expenses and in rendering accounts in connection therewith will be guided by the "Regulations governing financial transactions with the United States Department of Agriculture," approved by the Secretary June 1, 1894. These "Regulations" provide for the following:

Appointments.
Purchase of supplies.
Traveling expenses.
Station and field expenses.
Transportation of freight.
Passenger transportation.
Telegrams.
Accounts and blank forms.
Accounts for services.
Accounts for reimbursement of expenses.
Accounts for supplies, etc.
Signatures to receipts.
Miscellaneous instructions.

Extracts from the Revised Statutes relating to services, purchases, etc.

Services, etc., in open market.

Whenever it becomes necessary, under proper authority, to purchase articles or procure services in "open market," that is, without an advertisement and the opening of proposals, the observer, or other employee who is required to certify to the bill, will make the following certificate in addition to the one required in ordinary cases: "I certify that the prices charged for such labor and articles are reasonable and as low as they are furnished by regular dealers to private individuals in the locality."

(Signature) ——— ———.
(Grade) ——— ———.

Purchase of fuel or supplies not furnished.

Application for authority to make purchases or expenditures, in the case of fuel or other supplies not furnished from the central office, must be made annually on the prescribed form, and the application must contain a list of the articles needed and their lowest market price.

If the request be approved, authority will be given to procure the articles either in the open market or by formal proposals, as the case may be.

BIDS—HOW OBTAINED.

Instructions to bidders.

Circulars containing general instructions to bidders will be furnished, upon application, to be used in inviting proposals. These instructions must be thoroughly understood and carefully followed.

Circulars to be in duplicate.

When proposals are authorized to be invited, circulars, properly filled up and addressed to the public, will be furnished in duplicate to each bidder, together with special envelope in which to return the proposals.

Time bids are to be in, to be stated.

In filling up the circular a day and hour, at least ten days subsequent to the date of the circular, must be named when the bids are to be in, except where the bids are for current use. In the latter case the circular must indicate that the prices are to hold good during the fiscal year July 1 of one year to June 30 of the next, and a notice of at least thirty days must be given.

Information to bidders.

The same information must be given to each bidder, and if any drawings or specifications are included they must be securely attached to each circular.

Opening proposals.

At the designated time the proposals will be opened and abstract made. If the proposal of the lowest bidder is as low as or lower than the open market price, the observer will enter in the column of remarks the following certificate, signed in his official capacity: "I certify that the bids entered on this abstract were all that were received by me, that they were opened by me at —— o'clock ——, ———, 189—, and I recommend that the award be made to ——— ———, at $——, he (or they) being the lowest responsible bidder."

When lowest bid is higher than open-market price.

Where the lowest bid is higher than the open-market cost, the certificate should be changed to read as follows: "I certify that the bids entered on this abstract were all that were received by me, and that they were opened by me at —— o'clock ——, ———, 189—. I recommend that all the bids be rejected as the open-market cost is lower than any."

When award is recommended to be made.

When the award is recommended to be made to a bidder other than the lowest, full and definite reasons for so doing must be entered on the abstract.

All papers must be forwarded as soon as possible after bids are opened.

Persons invited to bid.

Where there are less than three dealers, the fact must be stated on the list of persons invited to bid, and that all dealers in the place were invited. A copy of the advertisement inviting proposals must be posted in a conspicuous place, which fact must also be stated on the list.

Effort must be made to obtain bids.

It is not sufficient for an official to report that no bids could be obtained unless every effort has been made to secure them. Each step required must be taken, and if at the time fixed for opening the bids none have been received, then only can it be stated that bids could not be procured. All the papers will be forwarded, with a letter of transmittal stating the action taken. In reckoning the number of days' notice, neither the date of the circular nor the date on which the bids are to be received will be counted.

Indorsement on envelopes.

Envelopes containing proposals must be indorsed plainly in red ink, with the exact date and hour upon which they were received.

Envelopes to be numbered.

Envelopes received marked "Proposals," which the observer has been directed to open, must be numbered in sequence, and each inclosure must bear a number corresponding to the envelope in which it was received.

If envelopes, after being received and numbered, are found to contain no bid, that fact will be stated in the letter of transmittal. It should also be noted on the abstract in the column corresponding to the number on the envelope.

Names of persons who did not bid.

The abstract should contain a list of persons invited to bid but who did not respond; it should also be stated that the notice was posted in a public place.

Certificate.

The certificate at the bottom of the abstract will be filled up and signed at the central office.

Bids received late.

Any envelope containing bids received after the time fixed must not be inclosed with the other bids but sent with a separate letter of transmittal, stating the exact hour and date and manner of receipt. The bids must be held until the time specified in the notices before being forwarded to the Chief of Bureau.

Bids for coal; kind to be stated.

In inviting bids for coal thirty days' notice will be given. The bidder will specify the number of pounds to the ton, the kind of coal, by its trade name, i. e., the name of the mine or locality where the coal is mined, such as Lehigh, Wilkesbarre, Schuylkill, etc., where and in what quantities it is to be delivered, whether anthracite or bituminous, and whether stove, egg, or chestnut. The same applies to wood, whether oak, ash, pine, etc., and the length and size into which it is to be cut.

BILLS—HOW RENDERED.

Number of pounds to be stated.

Bills for fuel must always specify the number of pounds to the ton of coal, or feet to the cord of wood.

Bills for services, when rendered.

Bills for services should be rendered quarterly when practicable.

Bills specially contracted.

Bills contracted under special letters of authority should, however, be forwarded immediately upon incurring the debt, and accompanied by the authority.

Report expense authorized but not incurred.

If any duly authorized expense is not incurred, the fact must be promptly reported and the letter of authority returned, in order that the authority may be canceled and the amount credited back to the appropriation.

Bills to be examined and certified.

Officials in charge of section centers will receive, examine, and certify to the correctness of all reports and bills from special stations, and then forward them to the central office.

Neglect to forward bills by special observers, etc.

If reports or bills are not received at the section centers within three days after the period at which they are due they will be called for by mail. Any persistent neglect of a special observer will be reported, with such recommendation as may be considered proper. Defective reports or bills which can not be remedied at section centers will be returned to the special stations for correction. Section centers *will report* on the 15th of each month *reports* or bills which have not been received from the substations for the previous months.

Precautions.

In certifying to bills, care will be exercised to see that the time for which charge is made is correct, the vouchers properly signed, etc. Bills will not be certified to until the reports which they cover are received and acted upon.

Missing reports.

When an observation or report has been missed, the fact will be noted on the face of the bill; for example, "No observation taken August 2 and 7." If extra observations have been taken, they will be entered.

Property to be accounted for before bill is certified.

Bills for services of an observer in charge of a special station will not be certified to by the observer in charge of the section center until the former has fully accounted for the property at his station.

Responsibility.

Observers in charge of sections will be held responsible for the correctness of all bills certified to by them, and they will assure themselves of their accuracy before forwarding them to the central office.

MISCELLANEOUS INSTRUCTIONS.

Rental of office.

Agreements with the person from whom the office is rented should be in duplicate, one copy to be retained and the other forwarded to the Chief of Bureau.

One of the stipulations should be that the landlords keep the rooms in tenantable condition.

No expense for repairs.

Repairing, painting, or papering, where the offices are not owned by the United States, should be done by the owners of the building.

Needed repairs to be reported.

When repairs are necessary, report the fact, in order that the landlord may be called upon to put the building or rooms in proper condition.

Expense book.

All purchases and expenditures must be noted in the station expense book in detail, the authority upon which contracted, etc. The accounts of substations need not be entered.

Private funds for official purposes.

Private funds will not be expended for official purposes, except as provided for in the "Regulations" as to "traveling expenses" and as follows: Officials may pay any properly authorized account less than $1, including those for drayage and cartage, taking a proper receipt therefor. When the aggregate amount of said bills is $1 or more an account may be rendered, in the name of the official, covering the several bills paid by him, the bills to be forwarded as subvouchers to the account.

Bills rendered.

On June 30 of each year all such bills on hand, whether they aggregate $1 or less, must be forwarded for settlement.

The account will, immediately upon its receipt at the central office, be put in course of settlement and the check promptly forwarded.

Unauthorized accounts.

The central office will not promise to reimburse for accounts not specially authorized under the rules in force.

TRAVELING EXPENSES.

Receipts for expenses.

Employees in incurring expenses in carrying out instructions will be guided by the "Regulations" in procuring receipts, etc., in connection therewith, and in rendering accounts for reimbursement of expenses.

Travel report.

Each employee will, as soon as the journey is completed, prepare in duplicate and forward (through the official in charge) with his account for reimbursement a travel report, as provided for on page 10.

Allowance while on temporary duty.

When employees of the Weather Bureau are ordered from one station to another for temporary services merely, their expenses for subsistence while so temporarily serving will be paid by the Government for a period not exceeding ten days, and at a rate not exceeding $1.50 per day. In special cases, however, the Chief of Bureau may, by prior notification, and with the approval of the Secretary, further extend or limit the time or increase or diminish the rate. In no case, however, will payment for board and lodging be made for periods greater than thirty days.

The allowance intended only to cover board, etc.

Such additional allowance is entirely distinct from and independent of the usual allowance for traveling expenses under existing regulations, and it will not be treated as extra compensation, as it is intended to cover only actual board and lodging at the station where such temporary service is rendered.

Expenses while traveling and first day of arrival.

The existing traveling regulations of the Department permit the payment of an employee's actual and legitimate hotel expenses for one day after arrival at a given station, to enable him to obtain a suitable lodging place; therefore, if not practicable for an employee to properly locate himself on the first day after arrival, that day need not be counted as one of the ten referred to in the first paragraph hereof, but may be charged for separately in his account at actual cost for board and lodging.

The aim of the Department is to approximate justice in each case of ordering an employee to a special duty at any other than his own station.

Receipts to be taken and rendered with travel account.

It is desired that each employee pay for the subsistence so received; taking proper receipts therefor, and including the items in his account for reimbursement of traveling expenses. Receipts for hotel expenses must be signed by the proprietor, or by the cashier as "cashier," by the clerk as "clerk," or by the manager as "manager," with full name. If at a place other than a hotel, receipts must be signed by the person to whom the money is due. The exact time covered by hotel and other receipts for board and lodging should also be distinctly stated in such receipts, giving the rate per day charged, and, if fractions of days are included, the items constituting such fractional days must be stated, as "from breakfast October 19 to dinner October 22, three and one-half days, at $1.50 per day, $5.25." (Circular, January 29, 1894.)

Transportation requests to be returned.

Transportation requests remaining on hand upon the completion of the journey or the revocation of the order on which they were issued will be returned with a letter of explanation. This will apply to all cases where journeys were performed without expense to the United States, or where the transportation was not required.

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